## PILOT'S FLIGHT OPERATING INSTRUCTIONS

P-51-D-5

# MUSTANG IV AIRPLANES

This Technical Order contains specific instructions for pilots and should be available for Transition Flying Training as contemplated in AAF Reg. 50-16.

This publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

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-LIST OF REVISED PAGES ISSUED-

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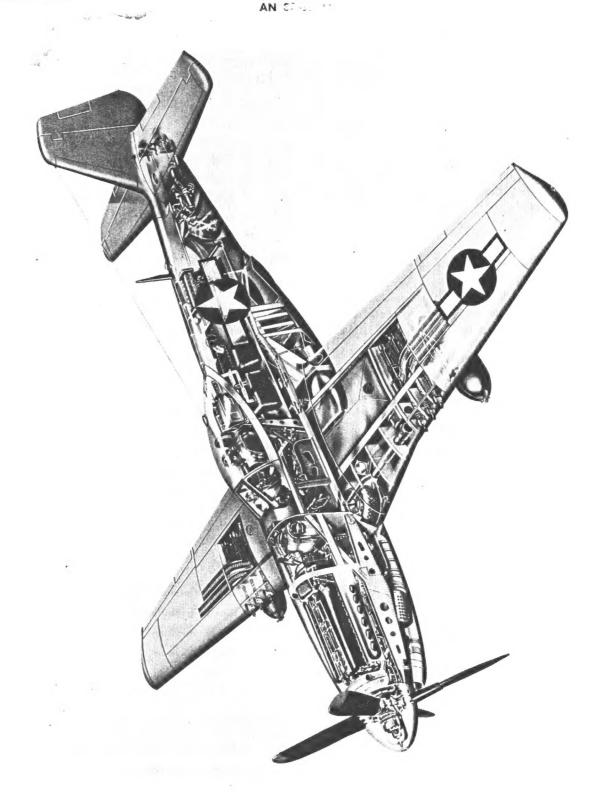
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BRITISH ACTIVITIES.—Sul mit requirements on Form 294A, in duplicate, to the Air Publications gate, Yorkshire, England.

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RESTRICTED



#### 1. GENERAL.

The North American P-51D Fighter Airplane is a single-place, low-wing monoplane powered by a V-1650-7 liquid-cooled engine. It has a wing span of 37 feet, a length of 32 feet 3 inches, and a height (tail down) of 12 feet, 2 inches. The airplane is armed with six .50-caliber machine guns and may be equipped with wing racks to carry bombs, depth charges, chemical tanks, or fuel tanks. The armor plate protection is shown in figure 8.

#### 2. FLIGHT CONTROLS.

The ailerons, elevators, and rudder are conventionally operated by a control stick and rudder pedals. Trim tab controls (a wheel for the elevator tabs and knobs for the rudder and aileron tabs) and the flap control lever are on the control pedestal at the left side of the cockpit. A surface control locking gear is forward of the base of the control stick.

#### 3. LANDING GEAR.

a. GENERAL.—The control lever for the hydraulically operated landing gear is on the left side of the cockpit. When the surface control stick is pulled back, the tail wheel is linked to the rudder cables and is steerable 6 degrees right or left. With the control stick forward, the tail wheel is unlocked and full swiveling.

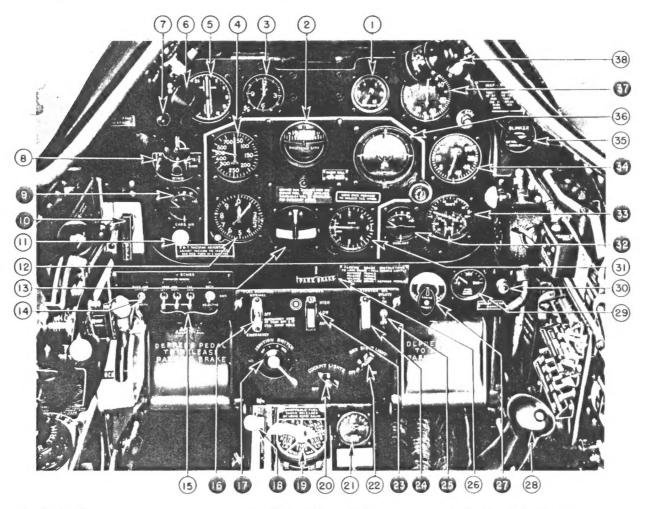
#### WARNING

Do not move the landing gear control when airplane is on the ground, as there is no safety mechanism to prevent the gear from retracting.

b. LANDING GEAR WARNING LIGHT.—A redjeweled light on the left side of the instrument panel will illuminate when the throttle is retarded with the landing gear not locked in the down position. A push-button switch for testing the lamp is adjacent to the warning light.

#### 4. BRAKES.

The multiple-disc brakes are hydraulically operated. Fluid for the brake system is obtained from the hydraulic reservoir. A standpipe in the reservoir reserves a supply of fluid for brake operation in case fluid for the hydraulic system is lost. The parking brake control is just below the center of the instrument panel. See figure 5 for brake system diagram.



- 1. Suction Gage
- 2. Directional Gyro
- 3. Clock
- 4. Airspeed Indicator
- 5. Remote Reading Compass Indicator
- 6. Fluorescent Light
- 7. Landing Gear Warning Light
- 8. Remote Contactor
- 9. Carburetor Air

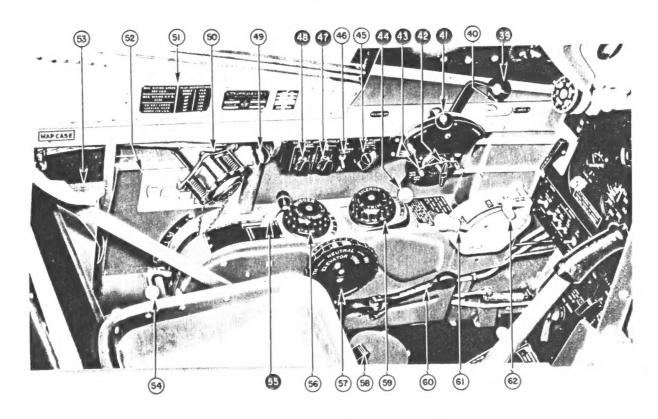
Temperature Indicator

- 10. Boost Control
- 11. Bank-and-Turn Vacuum Adjustment Knob
- 12. Altimeter

- 13. Bank-and-Turn Indicator
- 14. Gun and Camera Safety Switch
- 15. Bomb Control Switches
- 16. Booster Pump Switch
- 17. Ignition Switch
- 18. Fuel Shut-off Control
- 19. Fuel Selector Control
- 20. Cockpit Light Switch
- 21. Hydraulic Pressure Gage
- 22. Gun Sight Rheostat
- 23. Supercharger Control Switch
- 24. Starter Switch
- 25. Oil Dilution Switch

- 26. Parking Brake Handle
- 27. Engine Primer
- 28. Control Stick
- 29. Oxygen Pressure Gage
- 30. Oxygen System Warning Light
- 31. Rate-of-Climb Indicator
- 32. Coolant Temperature Indicator
- Oil Temperature and Fuel and Oil Pressure Gage
- 3-1. Tachometer
- 35. Oxygen Flow Blinker
- 36. Flight Indicator
- 37. Manifold Pressure Gage
- 38. Fluorescent Light

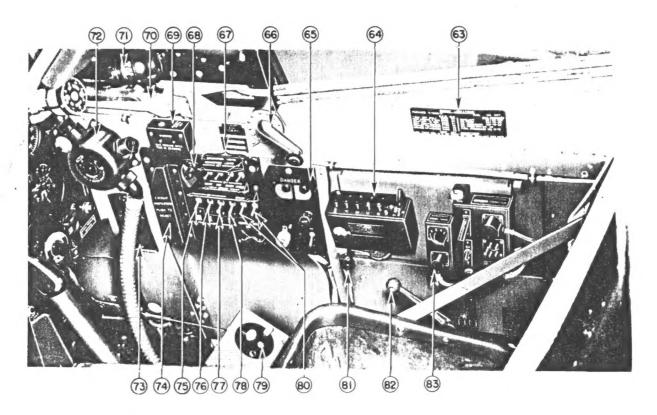
Figure 2—Cockpit—Forward View



- 39. Throttle
- 40. Throat Microphone Switch
- 41. Propeller Control
- 42. Throttle Friction Lock
- 43. Propeller and Mixture Control Friction Lock
- 44. Mixture Control
- 45. Left-hand Fluorescent Light Switch
- 46. Landing Light Switch
- 47. Oil Cooler Exit Flap Control Switch
- 48. Coolant Radiator Exit Flap Control Switch
- 49. Cockpit Light
- 50. Pyrotechnic Pistol Mount

- 51. Airplane Restriction Plate
- 52. Fuel System Diagram
- 53. Map Case
- 54. Wing Flap Control
- 55. Carburetor Air Control
- 56. Rudder Trim Tab Control
- 57. Elevator Trim Tab Control
- 58. Signal Lamp Stowage Bracket
- 59. Aileron Trim Tab Control
- 60. Landing Gear Control
- 61. Bomb Control Handle
- 62. Bomb Antisalvo Guard

Figure 3-Cockpit-Left Side



- 63. Engine Limitations Plate
- 64. SCR-522 Radio Control Box
- 65. Detonator Switches
- 66. Canopy Handcrank
- 67. Recognition Light Switches
- 68. Right-hand Fluorescent Light Switch
- 69. Recognition Lights Keying Switch
- 70. Canopy Emergency Release Handle
- 71. Fluorescent Light
- 72. Oxygen Regulator

- 73. Spare Lamp Stowage
- 74. Circuit Breaker Reset Guard
- 75. Generator-disconnect Switch
- 76. Battery-disconnect Switch
- 77. Gun Heater Switch
- 78. Pitot Heater Switch
- 79. Detrola Receiver
- 80. Position Light Switches
- 81. Cockpit Light
- 82. Seat Adjustment Handle
- 83. SCR-695 Radio Control Box

Figure 4-Cockpit-Right Side

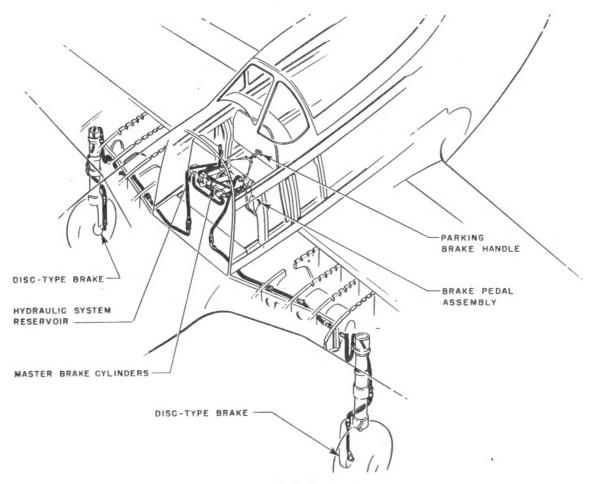


Figure 5-Brake System

#### 5. HYDRAULIC SYSTEM.

The hydraulic system (see figures 6 and 7) operates the landing gear and wing flaps. The wing flaps are preselectively set by moving the control lever, on the aft end of the control pedestal, to the desired flap setting. The flaps are automatically held in that position until another flap setting is selected. No emergency hydraulic hand-pump is provided.

#### 6. POWER PLANT.

a. ENGINE.—The Packard built Rolls Royce, V-1650-7, twelve-cylinder engine incorporates a two-speed, two-stage supercharger and is equipped with an injection-type carburetor and an automatic manifold pressure regulator. An aneroid switch automatically controls the supercharger shift. Low blower ratio is 5.8:1 and high blower ratio is 7.3 to 1. Field modification kits are available to change supercharger gear ratios, converting V-1650-7 to V-1650-3.

#### b. FUEL, OIL, AND COOLANT.

Fuel Spec. AN-F-28, Grade 100/130
Oil Spec. AN-O-5, Grade 1100
Coolant 70% water and 30% ethylene glycol
(Spec. AN-E-2) treated with
NaMBT

- c. ENGINE CONTROLS.—The engine control quadrant has two friction locks, one for the throttle and one for the propeller and mixture controls. The three mixture control positions are: "IDLE CUT OFF," "AUTO LEAN," and "AUTO RICH."
- d. CARBURETOR AIR.—The air induction system supplies either ram air or unrammed, filtered air to the carburetor. The control handle for the system is at the pilot's left. Whenever the air duct becomes obstructed, emergency

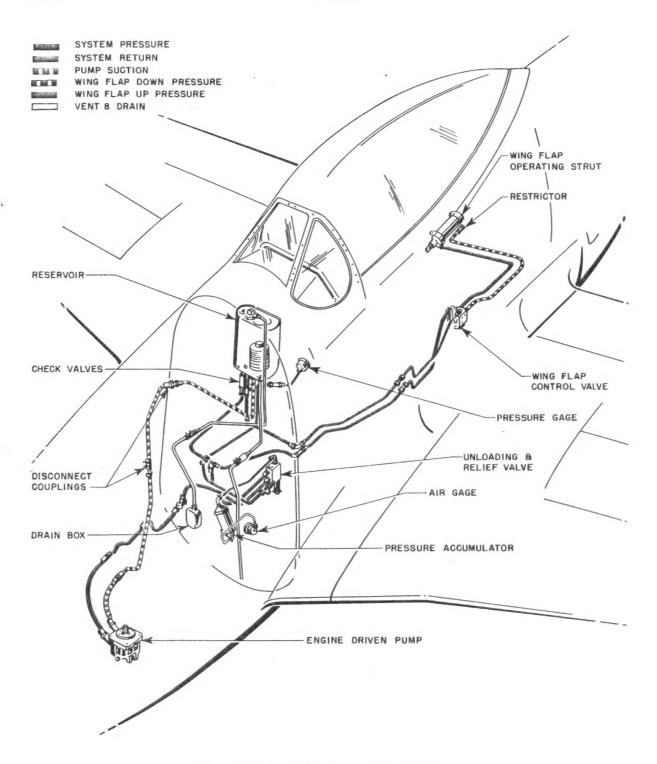


Figure 6-Hydraulic Power and Wing Flap Systems

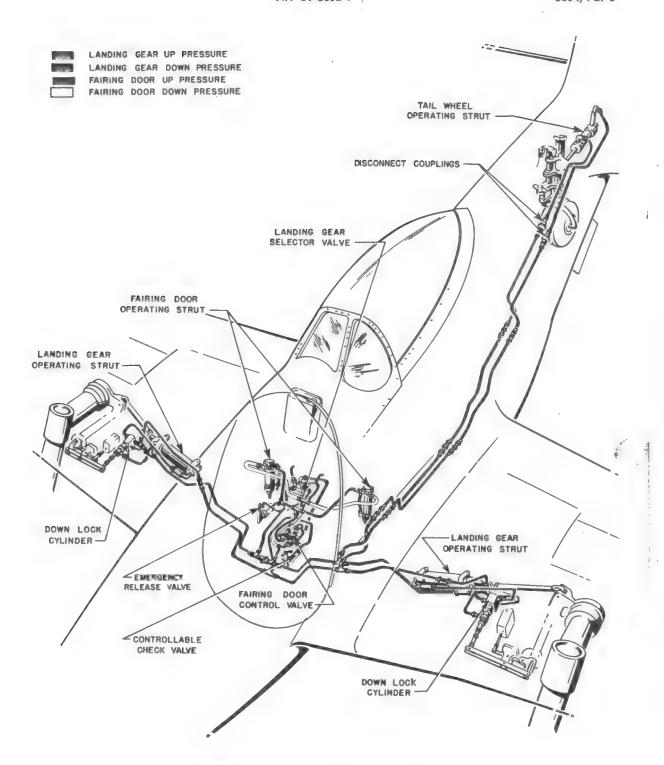


Figure 7—Hydraulic Landing Gear System

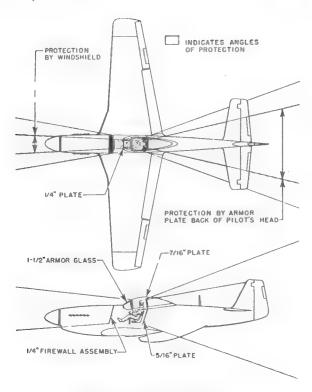


Figure 8-Armor Protection

doors will automatically open to allow engine compartment air to enter the carburetor.

e. PROPELLER.—The airplane is equipped with a Hamilton Standard, four-blade, hydraulically operated constant-speed propeller, 11 feet 2 inches in diameter. The pitch settings are 23° low, 65° high.

#### 7. FUEL SYSTEM.

Two self-sealing fuel tanks are carried in the wing, and an auxiliary 85-gallon, self-sealing tank is installed in the fuselage. The fuselage tank is located aft of the cockpit and is equipped with a goose-necked gage visible to the pilot. Two 75-gallon, pressurized combat tanks may be installed on the wing racks. Fuel flows as follows: from either of the wing tanks or the fuselage tank through a booster pump to the fuel selector valve; through the selector valve, shut-off valve, and fuel strainer to the enginedriven fuel pump; then to the carburetor. Fuel from the combat tanks flows through the selector valve into the main fuel line. All main fuel lines are self-sealing. See figure 9 for fuel system diagram.

#### NOTE

All airplanes equipped with 85-gallon fuselage fuel tanks may be identified by a white plus (+) sign printed below the serial number on the left-hand side of the fuselage.

#### 8. OIL SYSTEM.

The oil tank is mounted on the forward face of the firewall. Scavenged oil flows from the engine to an oil cooler located in the lower section of the fuselage, beneath the cockpit. A thermostatically controlled air duct exit flap regulates the flow of air through the oil cooler. The oil dilution system is controlled by a switch on the upper right side of the pilot's switch panel. The oil system is shown in figure 10.

#### 9. COOLING SYSTEMS.

The engine incorporates two cooling systems (see figure 11): one cools the engine and the other cools the supercharger fuel-air mixture. Each system has a separate pump, expansion tank, and radiator. The two coolant radiators, constructed as a unit, are located in the air duct above and aft of the oil cooler. An air duct exit flap, thermostatically controlled by the temperature of the main cooling system, regulates the flow of air through the radiators.

#### 10. ELECTRICAL SYSTEM.

The electrical system is a 2-i-volt direct-current type, receiving power from a 100-ampere engine-driven generator system supplemented with a 2-i-volt storage battery which supplies current when the generator system is inoperative. A single-wire direct current distribution system is used, the metallic structure of the airplane serving as a ground. An external power socket is located on the right side of the fuselage just behind the cockpit. External power should be used instead of the airplane battery to start the engine and operate the electrical system while the airplane is on the ground. An adapter for connecting the British type of external power supply is stowed adjacent to the external power socket. All of the electrical circuits are protected by either circuit breakers or circuit-breaker switches located on the right switch panel. See figures 2 and 1 for location of main electrical switches.

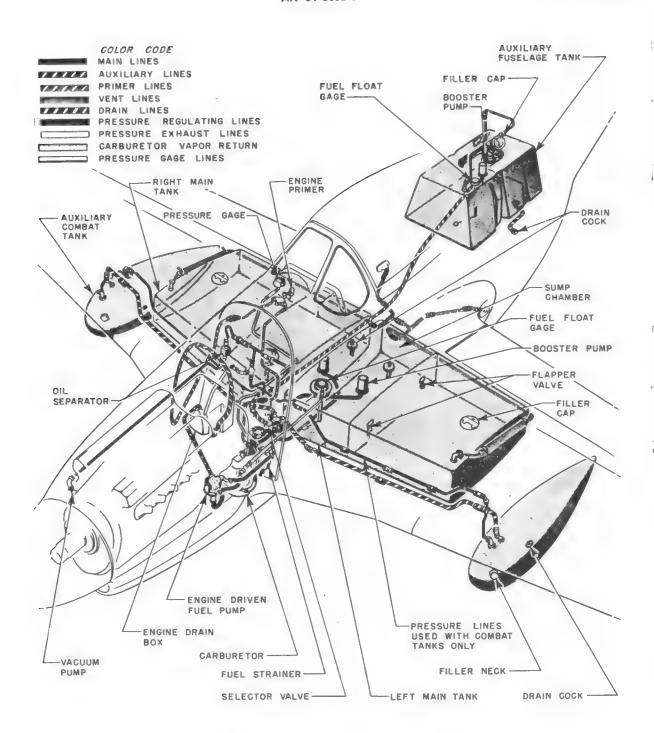


Figure 9-Fuel System

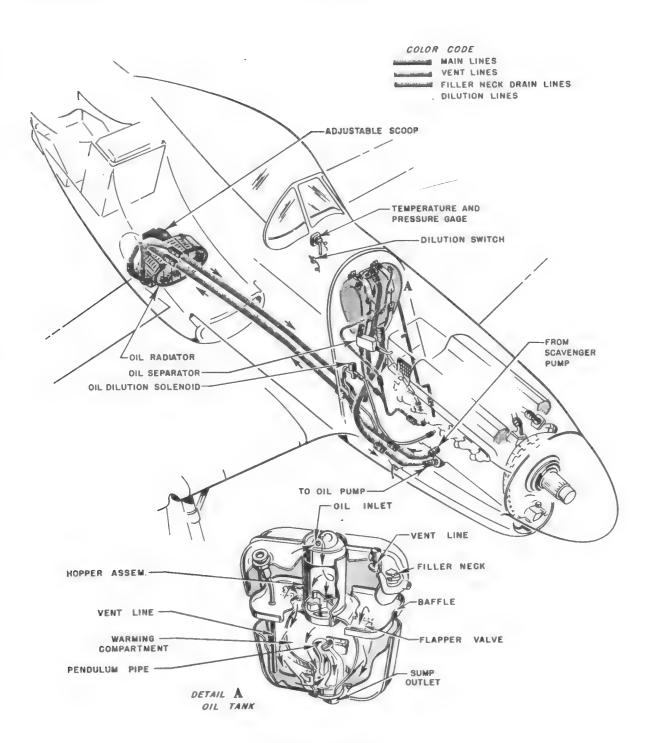


Figure 10-Oil System

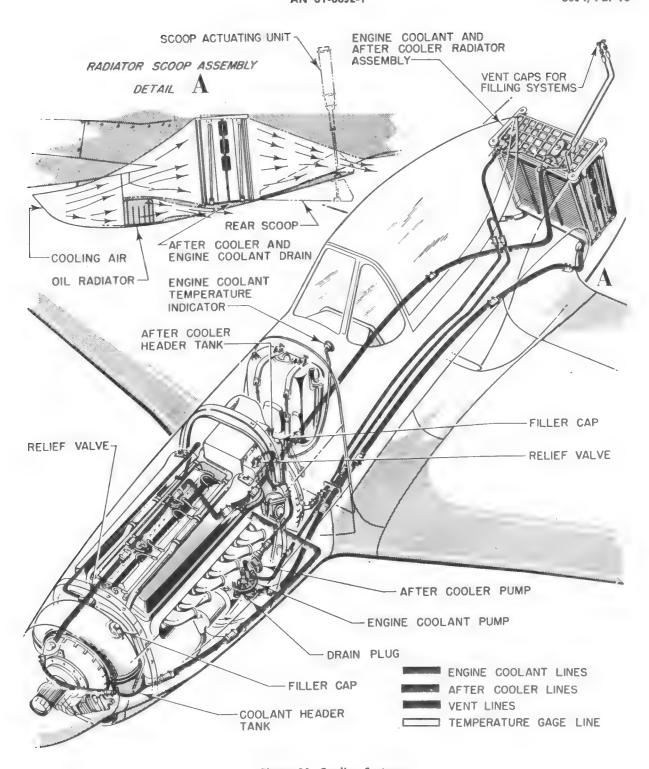
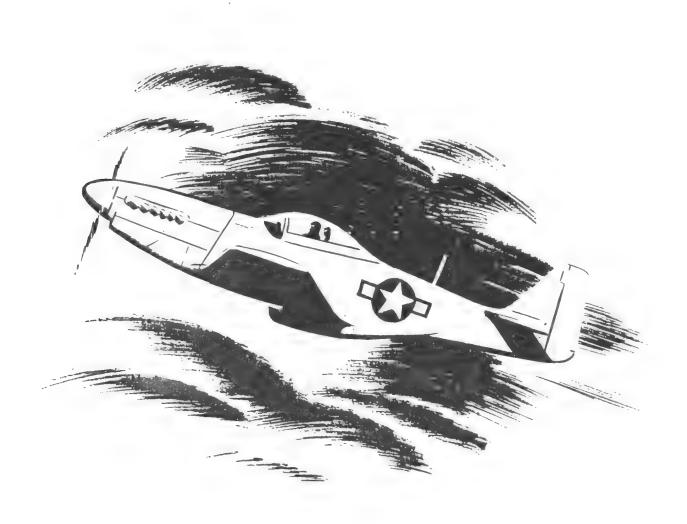
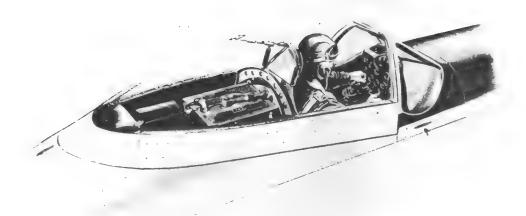


Figure 11—Cooling Systems

#### 11. MISCELLANEOUS EQUIPMENT.

- a. MEDICAL FIRST-AID KIT. A medical first-aid kit is fastened to a holder on the fuselage at the right of the pilot's seat.
- b. PILOT'S RELIEF TUBE.—The relief tube horn is stowed on a bracket on the floor to the left of the pilot's seat.
- c. DROP MESSAGE BAG. A drop message bag is contained in a holder on the map case cover.
- d. FLASHLIGHT. -A small flashlight is located on the left underside of the instrument cowl.
- e. ENGINE CRANK. An engine crank and extension tube are stowed on brackets at the back of the right main landing gear well.





## Pilots Operating Instructions

#### NOTE

A pilot's check list and an engine limitations plate are provided in the cockpit for a quick check of airplane operations.

#### 1.. FLIGHT RESTRICTIONS.

#### a. MANEUVERS PROHIBITED.

- (1) When external fuel tanks are installed, only normal flying attitudes are permitted.
- (2) Inverted flying must be limited to 10 seconds because of loss of oil pressure and failure of the scavenger pumps to operate in an inverted position.
- (3) Intentional "power-off" spins are permitted, provided such spins are started above 12,000 feet.
- (4) Intentional "power-on" spins and snap rolls are prohibited.

#### **6.** AIRSPEED LIMITATIONS.

- (1) The maximum permissible diving speed is 505 IAS.
- (2) Observe the following wing flap setting airspeed restrictions:

- (a) With wing flap setting at 10 degrees, do not exceed 400 IAS.
- (b) With wing flap setting at 20 degrees, do not exceed 275 IAS.
- (c) With wing flap setting at 30 degrees, do not exceed 225 IAS.
- (d) With wing flap setting at 40 degrees, do not exceed 180 IAS.
- (e) With wing flap setting at 50 degrees, do not exceed 165 IAS.
  - (3) In a sideslip, stay above 110 IAS.
  - (4) Do not extend landing gear above 170 IAS.
- (5) With droppable 75-gallon combat fuel tanks installed, speed is limited to about 400 IAS due to incipient buffeting.

#### 2. BEFORE ENTERING COCKPIT.

a. Make sure the airplane has been serviced and is ready for flight, particularly in regard to proper quantities of fuel, oil, coolant, hydraulic fluid, and oxygen.



Figure 12-Rudder Pedal Adjustment

- b. Ascertain that the total weight of fuel, oil, ammunition and special equipment carried is suited to the mission to be performed. This is most important in the case of combat missions, as the rate of climb of the airplane may vary as much as 500 feet per minute, depending on the load carried.
- c. Prior to any ground run-up exceeding 40 in. Hg manifold pressure, see that the tail of the airplane is anchored securely to a fixed object. If wheel chocks are available, use them also.
- d. To gain access to cockpit, push in on spring-loaded door on left forward side of sliding canopy, and slide canopy aft.

#### 3. ON ENTERING COCKPIT.

- a. The following procedures should be carried out prior to all flights:
- (1) Adjust rudder pedals for proper leg length so as to obtain full brake control while taxiing. Adjustment may be made with the foot by pressing the lever located on the inner side of each rudder pedal.
- (2) Adjust the seat level to obtain full travel of the rudder pedals in the extreme positions. The adjustment lever for raising or lowering the seat is located on the right side of the seat.
  - (3) See that ignition switch is "OFF."

- (4) Set parking brakes by pulling out the handle below the center of the instrument panel, depressing the brake pedals, releasing the pedals, and then releasing the handle.
- (5) On early airplanes only, make sure the bomb release handle is in the "LOCK" position and the antisalvo guard is in place.
- (6) See that the bomb and gun safety switches are "OFF."
- (7) See that landing gear control handle is in the "DOWN" position.
- (8) Unlock surface control lock at the base and just forward of the control stick by pulling the plunger on the left side of the lock. Check the controls for free and proper movement, watching control surfaces for correct response.
  - (9) Set altimeter to correct barometric pressure.
- (10) Test gun sight illumination by operating rheostat control on pilot's switch panel. (Gun safety switch must be moved to "GUNS" or "GUNS AND CAMERA" for test.)
- (11) Check remote reading compass for correct reading.
- (12) Check landing gear warning light on instrument panel by pushing test switch adjacent to light.
  - (13) Close sliding canopy as follows:
- (a) Push in on axle of crank on right side of cockpit to engage clutch.

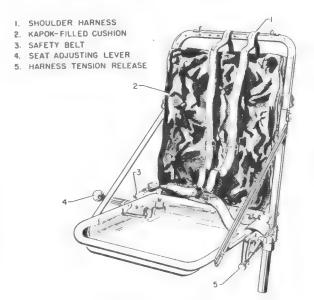


Figure 13-Pilot's Seat

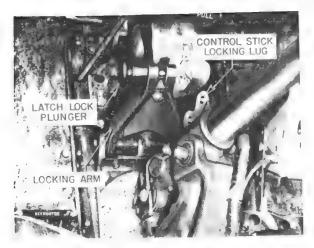


Figure 14-Surface Control Lock

- (b) Disengage pin on crank handle from the holes on the face of the clutch housing by pulling crank knob inboard gently.
- (c) Turn crank counterclockwise, holding knob inboard, to close canopy.

#### WARNING

If red indicators show through openings on each side of the forward end of the enclosure, the emergency release is unlocked and unsafe for flight.

- **b.** When night flying is anticipated, the following additional checks should be made:
- (1) Test fluorescent instrument lights by operating rheostat controls. The control for the left light is on the radiator air control panel; the control for the right light is on the right-hand switch panel.
- (2) Test position lights by moving switches on right-hand switch panel to "BRIGHT" and "DIM."
- (3) Test landing light by operating switch on radiator air control panel.
- (4) Test cockpit swivel lights on each side of cockpit by turning on switch located on lamp housing. The cockpit light master switch on the pilot's switch panel must be "ON" before turning on the lights.
- (5) Test operation of recognition lights; the switches are on the right-hand switch panel. The keying switch is on the right longeron.

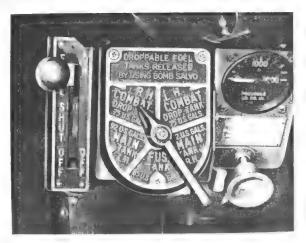


Figure 15-Fuel Selector Control

#### NOTE

Do not operate recognition lights longer than 10 seconds on the ground.

#### 4. FUEL SYSTEM MANAGEMENT.

a. Take off and climb to a safe altitude with the fuel selector valve on "FUS. TANK," and the booster pump switch in "EMERGENCY." If fuselage tank is not serviced, take off and climb with fuel selector valve on "MAIN TANK L.H."

#### NOTE

The fuselage tank should be used for take-off and climb to a safe altitude as it is the most direct system to the engine and is on a higher plane in relation to the engine. Use of the fuselage tank fuel will also move the C.G. of the airplane forward to a more desirable position for flight.

b. When a safe altitude has been reached, when droppable tanks are installed, switch fuel selector valve to either of the droppable tank positions and use the fuel from them alternately until they are empty; then drop them.

#### NOTE

The combat tanks have no booster pump; a controlled pressure of 5 lbs./sq. in. is maintained within the tanks by pressure obtained from the vacuum pump.

c. Switch selector valve back to "FUS. TANK," with booster pump switch in "NORMAL," and use all but 25 gallons of the fuel to relieve tail heaviness.

## PILOT'S OPERATING INSTRUCTIONS Sec II, Pars 4-5

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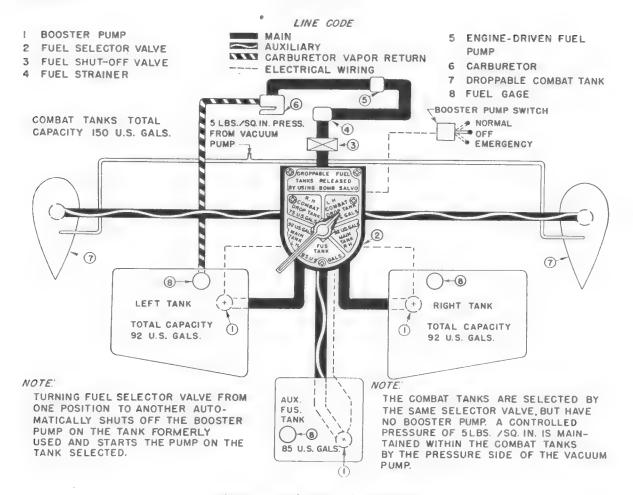


Figure 16-Fuel System Line Diagram

#### IMPORTANT

It is desirable to retain approximately 25 gallons of fuel in the fuselage tank in order to have the C.G. of the airplane in the optimum position for landing.

d. Switch selector valve to "MAIN TANK L.H."; alternately use fuel from the left and right main tanks to avoid wing heaviness until the wing tanks are empty.

#### NOTE

Turning the selector valve from one position to another automatically shuts off the booster pump on the tank formerly used and starts the pump on the tank selected.

e. When wing tanks are empty, switch selector valve back to "FUS. TANK."

#### 5. STARTING ENGINE.

- a. The sequence of operations listed below should be followed in starting the engine.
  - (1) See that ignition switch is "OFF."
- (2) Turn generator-disconnect and battery-disconnect switches "ON." These switches are located on the right-hand switch panel.
- (3) Have ground personnel turn the propeller several revolutions by hand.
  - (4) Open throttle one inch.
  - (5) Move mixture control to "IDLE CUT OFF."
  - (6) Move propeller control to full "INCREASE."



Figure 17—Pilot's Switch Panel

- (7) Make certain boost control on lower left side of instrument panel is in "AUTOMATIC."
- (8) See that supercharger blower switch on pilot's switch panel is in "AUTO."
- (9) Turn oil and coolant radiator air control switches at left side of cockpit to "AUTOMATIC."
- (10) Move carburetor air control at aft end of control pedestal to "RAM AIR" ("UNRAMMED FILTERED AIR," if required).
- (11) Turn ignition switch on pilot's switch panel to "вотн."
- (12) Turn "ON" fuel shut-off control, which is adjacent to the fuel selector valve at base of pilot's switch panel, place booster pump switch in "NORMAL," and turn fuel



Figure 18-Right-hand Switch Panel

selector valve to "FUS. TANK," or "MAIN TANK L.H." if fuselage tank is not serviced.

- (13) Check fuel pressure gage for 8 to 12 pounds pressure.
- (14) Prime engine 3-4 strokes when cold, one when hot.
  - (15) Check to see that propeller is clear.
- (16) Lift guard on starter switch on pilot's switch panel and press switch to "START."

#### NOTE

Whenever possible, an external power supply should be used to start the engine. If external power is not available, use handcrank. Use airplane's battery in an emergency only.



Figure 19-Radiator Air Control Panel

## PILOT'S OPERATING INSTRUCTIONS Sec II, Pars 5-7

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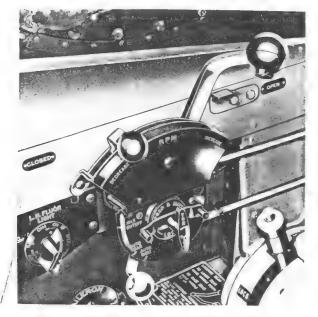


Figure 20-Engine and Propeller Controls

(17) As engine starts, move mixture control to "AUTO RICH." If engine does not start after several turns, continue priming.

#### WARNING

When engine is not firing, mixture control should be in "IDLE CUT OFF."

(18) Check oil pressure. If pressure is not up to 50 pounds within 30 seconds, stop engine and investigate.

#### 6. ENGINE WARM-UP.

Warm up the engine at 1300 rpm until the oil temperature shows a definite increase and the oil pressure remains steady when the throttle is opened. The desired oil and coolant temperatures will be maintained by having the radiator air controls in "AUTOMATIC."

	DASHIELD	MAXIMUM
Oil temp.	70- 80°C (158-176°F)	90°C (194°F)
Coolant temp.	100-110°C (212-230°F)	121°C (250°F)

If coolant and oil temperatures exceed limits with controls in "AUTOMATIC," shut engine off and investigate.

#### 7. EMERGENCY TAKE-OFF.

Use oil dilution (2 minutes maximum) to obtain proper oil pressure at moderate power, and as soon as the engine will take the throttle, taxi out, and take off.

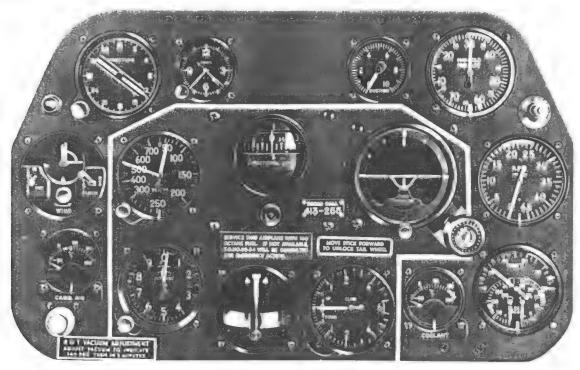


Figure 21—Instrument Panel

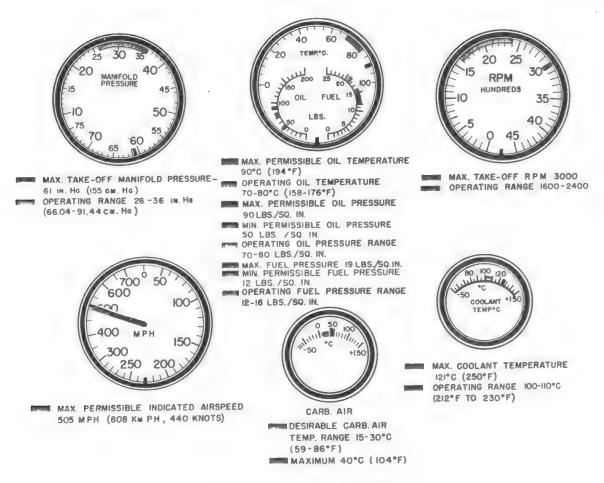


Figure 22—Instrument Limitations

#### NOTE

Overdilution is likely to result under these conditions because of low oil flow and a cold engine which holds back evaporation. If dilution is used, close observation of the oil pressure will be necessary during the time of dilution and take-off to determine whether or not the oil has been overdiluted, resulting in low oil pressure, and loss of oil through the engine breathers.

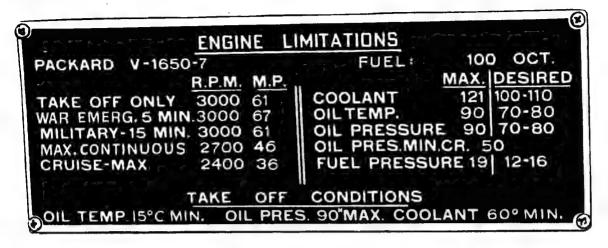
## 8. ENGINE AND ACCESSORIES OPERATION GROUND TEST.

- a. After the engine has been warmed up sufficiently, proceed with these tests:
- (1) Check both left and right main and fuselage fuel systems by rotating fuel selector with booster pump switch

 in "EMERGENCY." Check for 14-19 lbs./sq. in. pressure. If droppable tanks are installed, check fuel flow by rotating fuel selector control.

- (2) Check operation of wing flaps.
- (3) Check operation of radiator air exit flaps (with assistance of outside observer) using override positions of radiator air control switches. Return switches to "AUTO-MATIC."
- (4) Check communication equipment for proper operation.
  - (5) At 2000 rpm, check the following:

Suction 3.75-4.25 in. Hg
Hydraulic pressure 800-1100 lbs./sq. in.
Ammeter 100 amperes maximum



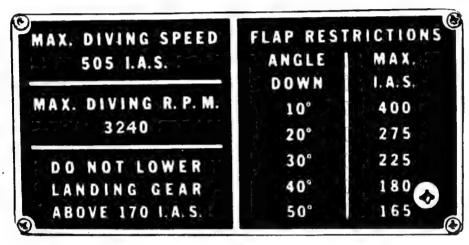


Figure 23—Engine and Airplane Limitations

(6) Check the instruments for the following limitations:

	. DESIRED	MUMIXAM
Oil pressure	70-80 lbs./sq. in.	90 lbs./sq. in.
Oil temp.	70-80°C (158-176°F)	90°C (194°F)
Coolant temp.	100-110°C (212-230°F)	121°C (250°F)
Fuel pressure	12-16 lbs./sq. in.	19 lbs./sq. in.

- (7) With propeller control in full "INCREASE," move throttle forward to obtain 2300 rpm. Check each magneto. A maximum loss of 100 rpm is allowable.
- (8) At 2300 rpm, move propeller control back to note maximum drop of 300 rpm. Then move forward to full "INCREASE."
- (9) Check supercharger operation: Set propeller control at full "INCREASE," engine speed 2300 rpm, and hold

supercharger switch in "HIGH." Note rpm drop (at least 50 rpm).

(10) Notify ground personnel to release tail and remove wheel chocks.

#### 9. TAXIING.

- a. Observe the following generalities when taxiing:
  - (1) Raise the wing flaps.

#### WARNING

To prevent damage to the wing flaps, they must be up when taxiing. In addition, always taxi cautiously so as to avoid damage from objects which the tires might pick up and throw against the radiator exit flaps.

- (2) Steer a zigzag course to obtain an unobstructed view.
- (3) Taxi with the stick slightly aft of neutral to lock the tail wheel. In the locked position, the tail wheel may be turned 6 degrees to the right or left by the rudder pedals. For sharp turns, push the stick forward of the neutral position to allow the tail wheel full swiveling action.
- (4) Use the brakes as little as possible and always taxi cautiously.
- (5) Upon reaching the take-off position, stop the airplane cross-wind so that approaching airplanes may be plainly seen.

#### 10. BEFORE TAKE-OFF.

- a. Follow this sequence of operations before take-off:
- (1) Set rudder trim 5° to the right, elevator trim 6° back for flaps down take-off; 3° back for flaps up take-off; aileron trim 0 degrees. With full combat and fuselage tanks and a full load of ammunition, set elevator trim ½ degree back for flaps down take-off.
- (2) Check flying controls for free movement (look at control surfaces).
  - (3) Check fuel levels.
- (4) See that fuel selector valve is set on "FUS. TANK" or "MAIN TANK L.H.," if fuselage tank is not serviced, and that booster pump switch is in "EMERGENCY" (pressure 14-19 pounds).
  - (5) Generator-disconnect switch "ON."
  - (6) Mixture control "AUTO RICH."
  - (7) Propeller control full "INCREASE."
  - (8) Supercharger blower switch "AUTO."
- (9) Oil and coolant radiator air controls "AUTO-MATIC."
  - (10) Boost control "AUTOMATIC."
- (11) Carburetor air control "RAM AIR" ("UNRAMMED FILTERED AIR," if required).
- (12) Sliding canopy closed and emergency release handle safetied.

#### 11. TAKE-OFF.

- a. When take-off area is clear, quickly check the following:
  - (1) Wing flaps 20° down ("TAKE-OFF" position).
  - (2) Gyro instruments "UNCAGED."

#### NOTE

The gyro instruments should be left "UNCAGED" at all times except during acrobatics.

- (3) Oil pressure 70-90 pounds.
- (4) Oil temperature 15°C (59°F) minimum, 90°C (194°F) maximum.
- (5) Coolant temperature 60°C (140°F) minimum, 121°C (250°F) maximum.
- (6) Open throttle to 61 in. Hg manifold pressure, and take off at 3000 rpm (5 minutes maximum).
- (7) Do not attempt to lift the tail too soon, as this increases the torque action. Pushing the stick forward unlocks the tail wheel, thereby making steering difficult. The best take-off procedure is to hold the tail down until sufficient speed is attained, and then raise the tail slowly.

#### 12. ENGINE FAILURE DURING TAKE-OFF.

- a. The chances of the engine failing during take-off can be greatly reduced and prepared for by observing the following practices:
- Run up engine carefully and check thoroughly before take-off.
- (2) Retract the landing gear as soon as the airplane is definitely airborne.
- (3) Raise the flaps as soon as the airplane reaches a safe altitude.
- **b.** If the engine fails immediately after the take-off, act quickly as follows:
- Depress the nose at once so that the airspeed does not drop below stalling speed.
- (2) If external fuel tanks or bombs are installed, release them immediately.
- (3) Release the sliding canopy by pulling the emergency release handle on top of the longeron just to the right of the instrument panel.

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#### IMPORTANT

When releasing the canopy, bend forward and lower head slightly so as to avoid a head injury from the loose enclosure.

- (4) Make sure landing gear has started to come up. There is no time to take further action, and even if it is only unlocked and on the way up, the gear will collapse on landing. Do not try to lower gear. There is less chance of personal injury if the airplane is landed with the gear up.
  - (5) Lower the flaps fully, if possible.
- (6) Move mixture control to "IDLE CUT OFF" and turn "OFF" ignition switch.
  - (7) Turn fuel shut-off valve "OFF."
  - (8) Turn battery-disconnect switch "OFF."
- (9) Land straight ahead, only changing direction sufficiently to miss obstructions.
- (10) After landing, get out of the airplane as quickly as possible and remain outside.

#### 13. CLIMB.

- a. As soon as the airplane is sufficiently clear of the ground, proceed as follows:
- (1) Retract the landing gear by pulling the landing gear control handle inboard and up. The handle is located on the control pedestal to the left and just forward of the seat.
- (2) Raise the flaps by pulling flap control to the full up position when sufficient airspeed is attained and all obstacles are cleared. No sink is noticeable when the flaps are raised.
- (3) Check the coolant and oil temperatures, and the oil pressure.
- (4) As the rate-of-climb can vary widely, depending on weight being carried, external loading, and altitude, refer to Take-off, Climb, and Landing Chart in Appendix II for the rate-of-climb applicable to the particular mission to be conducted.

#### 14. DURING FLIGHT.

#### a. GENERAL.

 As soon as desired altitude is attained, turn booster pump switch to "NORMAL."

- (2) Set propeller and throttle controls to desired rpm and manifold pressure.
- (3) Periodically check for these desired instrument readings:

Oil pressure 70-80 lbs. (50 lbs. min., 90 lbs. max.)
Oil temp. 70-80°C (158-176°F)
(15°C (59°F) min., 90°C (194°F) max.)
Coolant temp. 100-110°C
(60°C (140°F) min., 121°C (250°F) max.)
Fuel pressure 12-16 lbs.
Suction 3.75-4.25 in. Hg

#### NOTE

With the radiator air controls set in the "AUTO-MATIC" position, the coolant temperatures will be approximately 100-110°C (212-230°F) and the oil temperatures will be approximately 70-80°C (158-176°F). It should be noted that with very high powers on hot days, even though the radiator air controls are in the "AUTOMATIC" position, these temperature limits may be exceeded because the exit flaps are in the full-open position, making it impossible for the automatic control to maintain the above desired temperature limits.

(4) For engine operation, see Specific Engine Flight Chart, Section III, and Flight Operation Instruction Charts, Appendix II.

#### b. WAR EMERGENCY RATING.

#### (1) GENERAL.

- (a) The basis for establishing the War Emergency Rating, given on the Specific Engine Flight Chart in Section III, is to make available to the pilot in combat the absolute maximum manifold pressure at which the engine may be operated, within reasonable safety limits, for a 5-minute period under emergency conditions.
- (b) The War Emergency Rating is considerably in excess of the ratings given in the engine specification under which the engine was delivered. Use of the War Emergency Rating will decrease the engine's normal service life and time between overhauls, and therefore should be held for use only when emergency conditions exist. The War Emergency Rating is not a guaranteed power rating; it is a maximum manifold pressure rating, available for emergency operation only, as established by the correct setting of the automatic manifold pressure regulator, and the correct setting of the propeller governor to allow the propeller to turn at 3000 rpm.

- (c) The War Emergency Rating is to be used only when each of the following requirements is strictly complied with:
- 1. In combat or precombat areas as designated by the Army Air Forces, and then only when emergency conditions exist.
  - 2. When Spec. No. AN-F-28 fuel is used.
- 3. The mixture control must be set in the "AUTO RICH" position.
- 4. The propeller control must be set in the full "INCREASE RPM" position to maintain 3000 rpm.
- 5. When KLG RC 5/5 or Lodge RS 5/3 spark plugs are installed.
- 6. The break-through seal must be installed on the emergency boost control lever to inform the crew chief that the engine has been operated at War Emergency Ratings, so that he will then make special inspections and checks. Close co-ordination between the pilot, crew chief, and engineering officer will be required to maintain an accurate record of the time the engine has been operated at War Emergency Rating conditions. When five hours of War Emergency time have been accumulated, the engine should be pulled for tear-down inspection and reconditioning.
- 7. During the use of War Emergency Ratings, with Spec. AN-O-5, Grade 1100p lubricating oil in the system, the following oil inlet temperature must not be exceeded: 95°C (203°F) for 5 minutes.

#### CAUTION

It oil dilution has been used, it is desirable that the engine be given 10 to 15 minutes operation at from 80 percent normal to military power prior to the use of War Emergency Ratings.

- 8. During the use of War Emergency Ratings, the cooling system should be filled with 70 percent water and 30 percent ethylene glycol to AN-E-2 specification, and the coolant outlet temperature should not be permitted to exceed 121°C (250°F).
- The airplane must be placarded with a decal stating that War Emergency Ratings are permissible.
- (2) OPERATION.—If the airplane is so placarded and it is deemed necessary to use the War Emergency Rating, proceed as follows:
  - (a) Place mixture control in "AUTO RICH."
  - (b) Move propeller control to full "INCREASE."

- (c) Pull out on boost control lever from "AUTO-MATIC" to "EMERGENCY."
  - (d) Advance throttle to full open position.
- (e) Use War Emergency Rating for 5 minutes maximum.
  - (f) Push boost control lever in.

#### 15. ENGINE FAILURE DURING FLIGHT.

Follow instructions in Section IV, paragraph 2.

#### 16. FLYING CHARACTERISTICS.

a. GENERAL.—The airplane is stable at all normal loadings, but the directional trim changes at low speeds as speed and horsepower output is varied. The trim tab controls are sensitive and must be used carefully. The effect of flap and landing gear operation on the trim of the airplane in flight is as follows:

Landing gear retracted—airplane becomes tail heavy. Landing gear extended—airplane becomes nose heavy. Flaps lowered—airplane becomes nose heavy.

Flaps raised—airplane becomes tail heavy.

A sustained sideslip cannot be performed in this airplane; recovery should be effected above 200 feet.

b. FLIGHT CHARACTERISTICS FOR AIRPLANES WITH FUSELAGE TANK INSTALLATION.

#### IMPORTANT

The pilot should become accustomed to the handling qualities of the airplane with full fuselage tanks before engaging in any maneuvers. One or two hours of flying should acquaint the pilot with the airplane characteristics.

- (1) FUSELAGE TANK FULL.—The stability of the airplane improves rapidly as fuel is expended from the fuselage tank. The stick forces will reverse when entering a tight turn or attempting a pull-out with the fuselage tank full. Considerable forward pressure on the stick is necessary to prevent the airplane from tightening up in a turn or pull out to a marked degree. The tendency is more severe in left turns than in turns to the right. In this condition, it is practically impossible to turn the aircraft for hands-off level flight.
- (2) FUSELAGE TANK HALF FULL.—When this condition is reached, the stability is much improved. A slight tendency to tighten up is noticeable in left turns only

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and it is impossible to trim for hands-off level flight. The airplane stability improves rapidly and the flying characteristics are normal as more fuel short of the half-full position is used.

#### 17. MANEUVERS PROHIBITED.

- a. Only normal flying attitudes are permitted when the airplane is carrying external fuel tanks.
- **b.** The airplane should not be intentionally spun except under the following conditions:
- Intentional "power-off" spins will be permitted, provided such spins are started above 12,000 feet.
- c. Intentional "power-on" spins and snap rolls are prohibited.
- (1) It is impossible to do a good snap roll with the airplane and most attempts usually end up in a power spin.
- (2) In the event a power spin is entered inadvertently, the throttle should be closed immediately and normal recovery methods used. The controls must be held in the recovery position until full recovery is completed. Recovery from a two to five-turn power spin may require up to six turns with a loss in altitude of as much as 9,000 feet.

#### 18. STALLS.

The stall in this airplane is comparatively mild in that it does not whip at the stall but rolls rather slowly, and has very little tendency to drop into a spin. If the stick and rudder are released at the stall, the nose drops sharply and the airplane recovers from the stall almost instantly. When the stalling speed is reached, a wing will drop. If the backward movement on the stick continues when the wing drops, the airplane will fall into a steep spiral. In a straight "poweroff" stall, some warning is given about 3 to 4 mph above the stall by slight elevator buffet. A high-speed stall is preceded by sharp buffeting at the elevators and wing root, but recovery is almost immediate when pressure on the stick is released. Recovery from any stall in this airplane is entirely normal, that is, by the release of back pressure on the stick and the application of rudder opposite the dropping wing. As the speed at which a stall occurs can vary widely, depending on the gross weight and external loads of the airplane, the stalling speed charts, figures 24 and 25 should be carefully studied before flight.

#### 19. SPINS.

- a. DIFFERENCES.—There are marked differences between a sustained left and right spin in this airplane.
- (1) The left spin oscillates from 80 degrees below the horizon back to the horizon during the first turn, dampens out 50 percent during the second turn, and then becomes stable, smooth, and quiet with the nose approximately 30 to 40 degrees below the horizon.
- (2) The right spin starts exactly the same as the left spin, but the oscillations continue without increasing or decreasing in magnitude.
- b. RECOVERY.—Recovery procedure is the same in both a left and right spin. Upon application of opposite rudder, the nose drops slightly and the spin speeds up rapidly for 1½ turns, after which the spin stops. Rudder force is light at first, becomes very heavy for a period of about one second at the first half turn after starting recovery, then drops to zero as the spin stops. Recovery is effected in the normal manner, that is, by applying full opposite rudder followed by movement of the stick to neutral.

#### NOTE

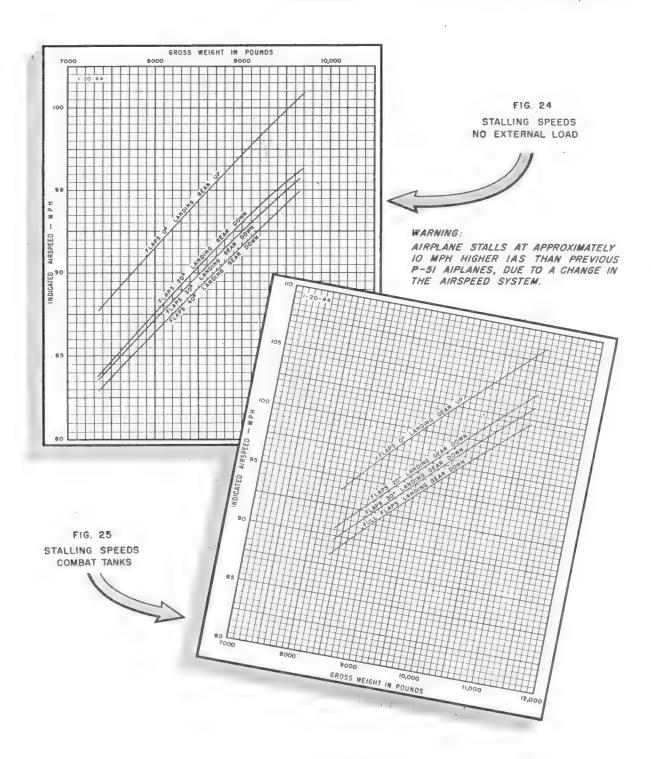
Slight rudder buffet occurs during the spin. If recovery from the dive is attempted too soon after the spin is stopped, a rather heavy elevator and rudder buffet will occur.

#### 20. ACROBATICS.

The acrobatic qualities of this airplane are exceptional, and the lateral control is excellent at all speeds. All acrobatics except snap rolls are permitted. However, inverted flying must be limited to 10 seconds because of loss of oil pressure and failure of the scavenger pump to operate in inverted position.

#### 21. DIVING.

The maximum permissible diving speed is 505 IAS, during which the engine speed must not exceed 3240 rpm. The use of elevator tabs is not required for dive recovery because of the low elevator control forces. As the airplane gains speed very rapidly in a dive, it is of utmost importance to make allowance of ample altitude for a safe recovery before starting the dive. The Estimated Diving Limitations Chart, figure 26, indicates the estimated minimum safe altitudes required for a pull-out from dives of



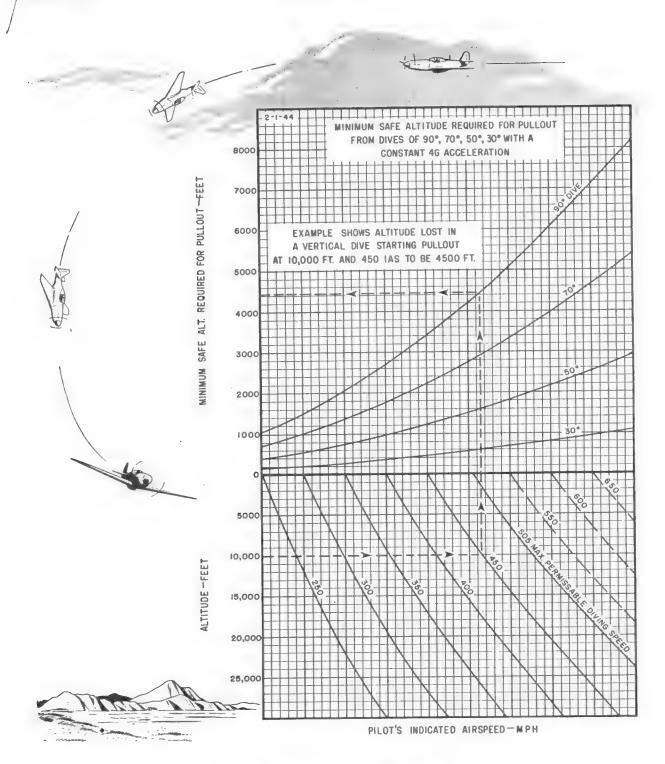


Figure 26—Estimated Diving Limitations

90°, 70°, 50°, and 30°, with a constant 4G acceleration. Pull-outs should not be attempted at greater than 4G's unless the pilot has special equipment to enable him to withstand greater accelerations without blacking out.

#### 22. GLIDING.

Gliding may be carried out at any safe speed down to the recommended margin of about 25 percent above stalling speed. With the landing gear and flaps up, the glide is fairly flat with the nose very high. Forward visibility in this condition is poor. Lowering either the flaps or landing gear, or both, greatly steepens the gliding angle, and the rate of descent is greatly increased.

#### 23. NIGHT FLYING.

#### IMPORTANT

Become accustomed to the position of the various light switches by feel, especially the switch for the landing light.

#### NOTE

Spare bulbs are contained in the small compartment on the right forward side of the cockpit.

- a. In flying this airplane at night, the sequence outlined for daylight operation should be even more strictly observed. In addition, the pilot should familiarize himself with the location of the different lights and their control switches.
- (1) INSTRUMENT LIGHTING.—Turn on the fluorescent lamps by turning the rheostat knobs (on radiator air control panel and right-hand switch panel) to "START" until the lights come on; then switch to either "ON" or "DIM" positions. Rotating the lens housing selects the visible or invisible illumination.
- (2) POSITION LIGHTS.—The position light switches are on the right-hand switch panel. Two intensities of light are available: "BRIGHT" and "DIM."
- (3) LANDING LIGHT.—The switch for the landing light is located on the radiator air control panel.
- (4) COCKPIT LIGHTS.—A cockpit swivel light is on each side of the cockpit. Turn on light by turning switch on lamp housing. The cockpit light switch on the pilot's switch panel must be "ON" before operating the lights.
- (5) RECOGNITION LIGHTS.—Set the switches, located on the right-hand switch panel, for the light or combination of lights desired. Place the switches in "STEADY"

position for continuous operation and in "KEY" position for intermittent operation, by means of the keying switch on the right longeron.

#### 24. APPROACH AND LANDING.

- a. APPROACH.—When the airplane approaches the field, this sequence of operations should be followed:
  - (1) Mixture control "AUTO RICH."
- (2) Oil and coolant radiator air controls "AUTO-MATIC."
- (3) Fuel selector valve to either "MAIN L.H.," "MAIN R.H.," or "FUS. TANK." Booster pump switch "NORMAL."
  - (4) Propeller control set for 2700 rpm.
- (5) Lower the landing gear below 170 IAS. Check position of gear by the warning light on the instrument panel.
- (6) If desired, the flaps may be lowered 15 degrees to give a steeper approach angle. When the airplane has been brought into the wind for landing, the flaps should be lowered fully at an altitude of at least 400 feet, provided the indicated airspeed is below 165 IAS and above 100 IAS.

#### b. LANDING.

- (1) GENERAL.—Having turned into the field and lowered the flaps, maintain a correct gliding speed. Adjust the elevator trim tab to assist in landing. Having stopped after landing, raise the flaps before taxiing.
- (2) CROSS-WIND LANDING.—As this airplane has a landing gear of wide tread and a locked tail wheel, cross-wind landings may be negotiated safely. Keep one wing down, into the wind, to counteract drift.
- (3) TAKE-OFF IF LANDING IS NOT COM-PLETED.—In the event of an unsuccessful attempt to land, open the throttle and then push the propeller control forward to full "INCREASE." Raise the landing gear immediately; then, when the airspeed has reached 100 IAS, raise the flaps.

#### 25. STOPPING ENGINE.

- a. To stop engine, proceed as follows:
  - (1) Turn booster pump switch "OFF."
- (2) If a cold weather start is anticipated, hold oil dilution switch, on pilot's switch panel, "ON" (2 minutes maximum).

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- (3) Run engine to 1500 rpm, set mixture control to "IDLE CUT OFF" and move throttle fully open. Leave mixture control in "IDLE CUT OFF" as a precaution against accidental starting.
- (4) Turn ignition switch to "OFF" after the engine ceases firing.
  - (5) Turn "OFF" fuel shut-off valve.

#### 26. BEFORE LEAVING COCKPIT.

- a. After engine stops, proceed as follows:
  - (1) Turn "OFF" all switches.
  - (2) Set parking brakes.

#### WARNING

If brakes are hot as a result of frequent applications, wait until they have cooled before applying parking brakes. Otherwise, the brake discs will fuse to each other.

- (3) Lock the control surfaces.
- (4) Place the carburetor air control in "UNRAMMED FILTERED AIR" position.
- (5) Pull out on sliding canopy crank handle, place pin between holes on face of clutch housing, and push on knob of handle. This will disengage crank axle from clutch and allow canopy to be moved manually.
  - (6) Close canopy after leaving cockpit.

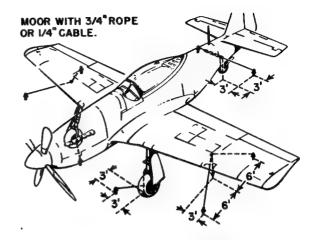


Figure 27—Mooring Airplane

#### 27. TYING DOWN.

- a. Head the airplane into the wind.
- b. Set the parking brakes.
- c. Lock the surface control lock, using the lower locking notch on the control stick in order to lock the tail wheel.
- d. Moor the airplane with \(^3\)/4-inch rope or \(^1\)/4-inch cable. Secure the wing with two ropes at each of the mooring rings in the wing, one tied 6 feet forward and 3 feet outboard, and one tied 6 feet aft and 3 feet outboard of each mooring ring. Secure each main landing gear towing lug to the ground with a rope tied 3 feet forward and 3 feet inboard of the respective towing lug. Moor the tail section of the fuselage to the ground with one rope strung through the lift tube and tied on each side of the airplane, 2 feet aft and 3 feet outboard of the lift tube.
  - e. Install engine and cockpit covers.





#### 1. SPECIFIC ENGINE FLIGHT CHART.

- a. Operating limitations and characteristics of the V-1650-7 engine are summarized for ready reference on the Specific Engine Flight Chart (figure 28). A similar chart (figure 29), applicable to the V-1650-3 engine, is provided for use on airplanes which have had V-1650-3 engines installed in service. The pilot should be thoroughly familiar with this information.
- b. Engine power ratings shown on the chart are defined as follows:
- TAKE-OFF.—Maximum recommended for takeoff under the specified time limit of five minutes.
- (2) WAR EMERGENCY.—Maximum allowed for emergency operation during combat for a period not exceeding 5 minutes.
- (3) MILITARY.—Maximum recommended for operation for periods not exceeding 15 minutes.
  - (4) MAXIMUM CONTINUOUS.—Maximum rec-

ommended for operation with rich mixture in climb and level flight.

- (5) MAXIMUM CRUISE.—Maximum recommended for operation with lean mixture.
- (6) MINIMUM SPECIFIC CONSUMPTION.—The power at which greatest range can be obtained under average loading conditions.

#### 2. AIRSPEED CORRECTION CHART.

INDICATED AIRSPEED-MPH	CALIBRATED INDICATED AIRSPEED-MPH	ALTIMETER ADD TO INSTR S.L.		
180	181.5	20	25	35
210	212	25	35	45
240	242	30	45	60
270	272	35	50	70
300	302	45	60	85
330	332	50	70	100
360	362.5	60	85	115
390	393	70	100	140

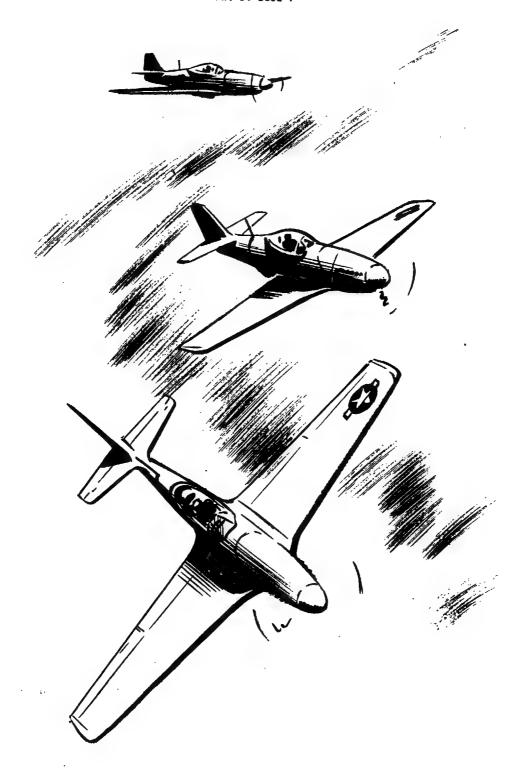


2116	AIRPLAI	NE MODELS				CDEC	, iei				ENG	ENGINE MODELS	ODELS	
EC. AN-1	P-510		ı	:			CH C	FLIGHT CHART	u		PAC	PACKARD V-1650-7	650-7	
ag .				:										
NOTIONOL	FUR	JIO	OIL	_ :	COOLANT	ANT			MAX. PERMISSIBLE		DIVING RPM:3240	PM:3	3240	
	(IB/5Q. IN.)		ņ		٥				CONDITION	ž	ALL	ALLOWABLE OR CONSUMPTION	NCONSI	MPTION
DESIRED	12-16	70-80	70-80	158-	82	212-			MAX. CONT.	_	U.S.QT/HR	J.S.QT/HI		IMP.PT/HR
MAXIMUM	61	8	8	#6.T	121	250			MAX. CRUISE		J	U.S.QT/HR.	:	IMP.PT/HR
MINIMUM	12	90	2	28	9	011			MIN. SPECIFIC	$\vdash$	3U.S.QT/HR.	J.S.QT/HR		IMP.PT/HR
IDLING	6	- 15							OIL GRADE:	(5)	00			OIL GRADE: (5)!! (99(W)1190
SUPERCHARGER TYPE:	ER TYPE:	TWO SPEED, TWO STAGE	STAGE					,	RUEL GRADE	RADE	SPEC. AM-I	AM-F-28 130		OCTANE 100
OPERATING		MANIFOLD	HORSE-	5	MCAL /	CRITICAL ALTITUDE	NEE .	USE LOW	MIXTURE	FUEL	FUEL ROW	MAXIMUM CYL, TEMP.	MA.	MAXIMUM
CONDITION	W.	(BOOST)	POWER	WIT.	WITH RAM	NO RAM	BEOA	BELOW:	POSITION	US.		ņ	<u>.</u>	(MINUTES)
TAKE-OFF	3000	19	0611			s.t.	FOM		A.R.	191				ro.
WAR EMERGENCY	3000	67	1720			6,200	H GH		A. A.	<u>s</u> 26				so.
MUTARY	3000		1590			8,500	LOW H 1 GH		A A	178				15
MAXIMUM CONTINUOUS	2700	9#	08 C			11,300	LOW H GH		A.R. A.R.	108				COMT.
MAXIMUM CRUISE	2400	36	820 760			14,000	K I GH		A.L. A.L.	2 2				CONT.
MINIMUM SPECIFIC CONSUMPTION														
REMARKS: AL	ADDITIONAL	INFORMATION	WILL B	E INC	RPORA	TED IN T	HIS CHA	INFORMATION WILL BE INCORPORATED IN THIS CHART WHEN AVAILABLE	LABLE.					

Figure 28—Specific Engine Flight Chart—V-1650-7

EC. AN.														
DE	d.	20		; ;		Ĭ	당	FLIGHT CHART			PACKA	PAÇKARD Y-1650-3	50-3	1650-3
	FUEL	$\vdash$	io ii		COOLANT	ANT			MAX. PERMISSIBLE		DIVING RPM:	:	3240	
CONDITION	PRESSURE	PRESSURE	TEMP.		TEMP				CONDITION	_	ALLO	ALLOWABLE OR CONSUMPTION	CONSU	MPTION
DESIRED	12-16	-	70-80	-58- 26-	1.	212-			MAX. CONT.	$\vdash$	U.	U.S.QT/HR.		IMP.PT/HR
MAXIMUM	61	8	8	<u>₹</u>	+	250			MAX. CRUISE	-	, t	U.S.QT/HR.		IMP.PT/HR
MINIMUM	12	20	-15	59	9	0#1			MIN. SPECIFIC	4	3U.	.U.S.QT/HR		.IMP.PT/HR
IDFING	6	51							OIL GRADE: (S)	() · · · · (S	80	8	.1100	
SUPERCHARGER TYPE	GER TYPE:	TWO SPEED, TW	TWO STAGE						FUEL GRADE:		SPEC. AN-F-28 GRADE 130	-28	0	OCTANE 100
OPEDATING		MANIFOLD	100 E		STICAL /	CRITICAL ALTITUDE	AEK	USE LOW	MIXTURE	FUE ROW	TOW	MAXIMUM CYL, TEMP.	Σģ	MAXIMUM
CONDITION	RPM	PRESSURE (BOOST)	POWER	MIII	WITH RAM	NO RAM	81OA	BELOWER BELOW:	POSITION	U.S.		ņ	i.	(MINUTES)
TAKE-OFF	3000	19	001	89	S.L.	3.L.	100		AR	150				<b>L</b>
WAR	3000	29	1595	12	17,000	11,700	2		AR	991				ĸ
EMERGENCY			1295	28	28,800	23,200	HIGH		AR	160		+	+	
MILITARY	3000	19	1450	61	19,800	13,700			AR S	28				70
MIMINA			0611	5 6	30,500	17.500	5 6		W 84	Ξ			T	100
CONTINUOUS	2700	9	96	ੇ ਲੱ 	34,400	29,500			¥	90-			7	
MAXIMUM	2400	36	800	21	21,500	18,500	101		¥.	灵				Face
CRUISE		36	700	32	32,300	30,500	H GH		AL	70				1 100
******	1600	27	370	SO L	S.L.		53		4=	S 2				
SPECIFIC	0091	9 8	180		88		5 5		। द	<u>7</u>				CONT.
CONSUMPTION	NC 2000	111	5.0 560	502	20,000		, C C		44	\$ S				

Figure 29—Specific Engine Flight Chart—V-1650-3





# 1. GENERAL.

All emergency instructions, except those included in Section II, have been assembled in this Section to facilitate quick reference. The pilot should thoroughly acquaint himself with these instructions before his first flight in this airplane.

# 2. ENGINE FAILURE DURING FLIGHT.

- a. If the engine fails during flight, the airplane may be abandoned, ditched, or brought in for a dead-stick landing, as the case requires. For a landing with the engine dead, follow these instructions:
- Depress the nose at once so that airspeed does not drop below stalling speed.
- (2) If external fuel tanks or bombs are installed, release them immediately (see paragraph 6).
- (3) Release the sliding canopy by pulling emergency release handle on right longeron.

# WARNING

Bend forward and lower head slightly when pulling release handle so as to avoid injury from the lousened canopy. If the canopy does not fly off, move it back with handcrank.

- (4) Do not lower the landing gear. There is less chance of personal injury if the airplane is landed with the gear up.
  - (5) Lower the flaps fully, if possible.
- (6) Move mixture control to "IDLE CUT OFF" and turn ignition switch "OFF."
- (7) Turn "OFF" fuel shut-off valve and battery-disconnect switch.
- (8) Land into the wind, only changing direction sufficiently to miss obstructions.
- (9) After landing, get out of the airplane as quickly as possible and remain outside.

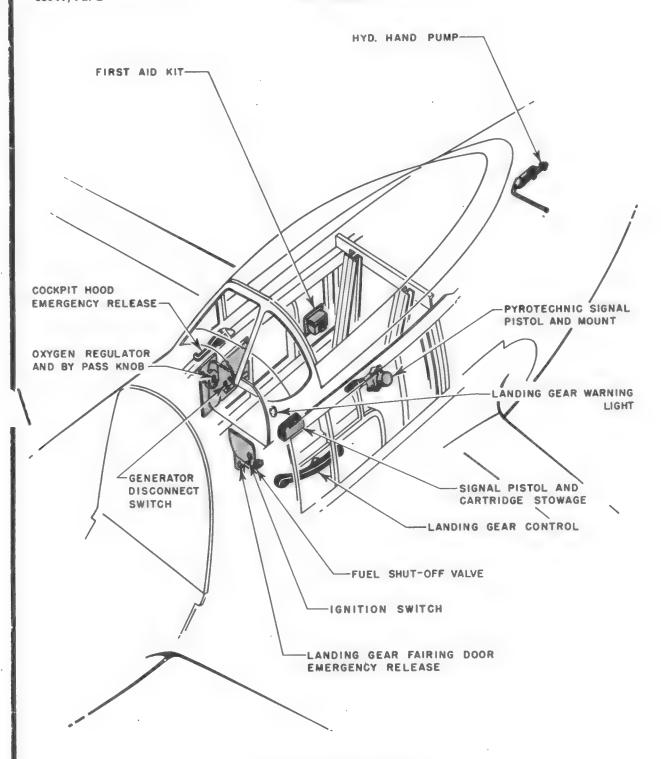


Figure 30—Emergency Equipment

# 3. EMERGENCY EXIT DURING FLIGHT.

- a. In the event that an emergency exit must be made during flight, the following proceduces are recommended:
- (1) Release sliding canopy and unfasten safety belt and shoulder harness. Roll airplane over on its back and drop out.
- (2) Release sliding canopy and unfasten safety belt and shoulder harness. Climb out of cockpit, lower self onto wing, and roll off.

# IMPORTANT

When pulling emergency release handle, bend forward and lower head slightly to avoid head injury when canopy releases.

# 4. DITCHING.

- a. The airplane should be ditched only as a last resort. If, on an overwater flight, trouble arises and the pilot is quite certain that he will not be able to reach land, he should leave the airplane while in flight. However, if it is not possible to maintain sufficient altitude for a successful parachute drop, ditching is the only remaining procedure. The instructions for ditching are as follows:
- (1) If bombs or droppable tanks are installed, release them immediately.
- (2) Release sliding canopy. (See IMPORTANT note in paragraph 3.)
- (3) Be sure the shoulder harness and safety belt are fastened securely, as there is a violent deceleration of the airplane upon final impact.
- (4) Land into the wind with landing gear up. As soon as the airplane comes to rest, get out *immediately*.

# DANGER

The pilot must get out quickly upon landing. After the final impact, the airplane will sink very rapidly, only remaining above the surface of the water for a period of  $1\frac{1}{2}$  to 2 seconds.

# 5. LANDING GEAR EMERGENCY LOWERING.

In the event of hydraulic system failure, the landing gear may be lowered by placing the landing gear control handle in the down position and yawing the airplane sideways. If the landing gear warning light does not go out when the throttle is retarded, pull the fairing door emergency knob, located just forward of the control stick, and then yaw the airplane sideways to force the gear into the locked position. If the tail wheel does not lock, increase the airplane's speed to increase the air load on the partially extended wheel, or dive the airplane a short distance and pull out with enough acceleration to down the tail wheel.

# 6. EMERGENCY BOMB OR DROPPABLE FUEL TANK RELEASE.

The bombs or droppable fuel tanks are released as follows:

- a. EARLY AIRPLANES.—Hinge antisalvo guard upward and move bomb release handle to "SALVO."
- **b.** LATE AIRPLANES.—Pull out on both emergency bomb release handles at left side of instrument panel.

# 7. EMERGENCY USE OF OXYGEN.

If for any reason there is a lack of oxygen or if no oxygen flow is indicated by the flow indicator, immediately turn "on" the red emergency knob on the regulator.

# 8. USE OF MISCELLANEOUS EMERGENCY EQUIPMENT.

- a. RADIO DEMOLITION SWITCH.—This switch, on the right side of the cockpit, controls a charge for demolishing the identification radio in an emergency. Press both buttons simultaneously to set off the charge.
- b. FIRST-AID KIT.—The contents of the first-aid kit are to be used only in an emergency when medical aid is not available. Use contents of kit in accordance with the directions contained therein.
- c. LIFE PRESERVER.—The back cushion on the pilot's seat is filled with kapok and may be used as a life preserver.







### NOTE

The following instructions apply only to operational equipment not used in the actual flying of the airplane. For flight operating instructions, see Section II.

# 1. GUNNERY EQUIPMENT.

a. DESCRIPTION.—Either of two gun installations may be used: a maximum load of three fixed .50-caliber guns in each wing or an alternate installation of two guns in each wing. The maximum load includes 500 rounds of ammunition for each inboard gun and 270 rounds for each center and outboard gun. When the alternate installation is used, the center guns are removed, and 500 rounds of ammunition are provided for each outboard gun. An optical gun sight and an auxiliary ring sight are mounted on the instrument cowl; a bead sight is forward of the windshield. A Type N-4 gun sight aiming point camera equipped with an overrun control is mounted in the leading edge of the left wing.

## b. OPERATION.

(1) On missions requiring gun heat, turn "ON" gun heater switch immediately after starting engine. Turn switch "OFF" when firing guns.

- (2) On combat missions, turn gun and camera safety switch to "GUNS AND CAMERA" as soon as the airplane is safely off the ground. Doing this eliminates the possibility of the pilot forgetting to turn the switch on during the excitement of combat.
- (3) To sight guns, turn gun sight rheostat, on right side of pilot's switch panel, toward "ON." Turning the rheostat in a clockwise direction increases the light intensity of the image. The gun sight will not operate until the gun and camera safety switch has been turned on.

## NOTE

If the optical gun sight fails to function, install the ring sight by slipping the ring sight stem over the stud provided and rotating the ring sight to the left into the stem clip.

(4) Fire guns by squeezing trigger switch on control stick grip. To operate camera only, turn gun safety switch to "CAMERA" and squeeze trigger switch.

# NOTE

When the gun and camera safety switch is on, the heaters in the camera will function automatically at low temperatures. Therefore, make certain the safety switch is "OFF" whenever the guns and camera will not be required.

RESTRICTED 37

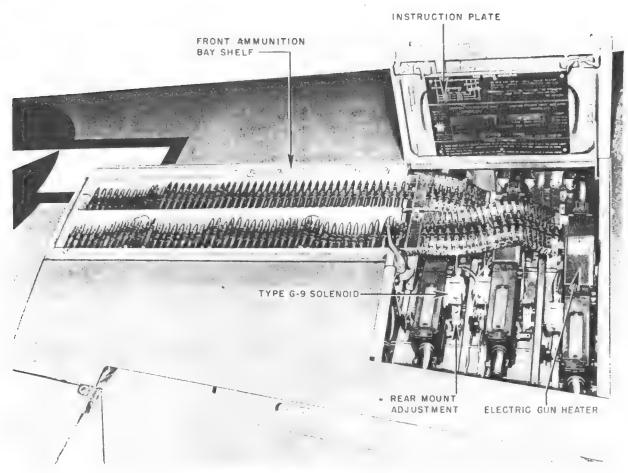


Figure 31—Wing Gun Installation

(5) Before landing, make sure that the gun and camera safety switch and gun heater switch are "OFF."

# 2. BOMBING EQUIPMENT.

a. DESCRIPTION.—An external, removable bomb rack may be installed under each wing. Each rack will hold one 100, 250, or 500-pound bomb. Chemical tanks or combat fuel tanks may be carried on the bomb racks when bombs are not installed. The tanks are released either by normal or salvo operation of the bomb control system. On early airplanes, a bomb salvo handle, on the left side of the cockpit, salvoes the bombs simultaneously. On late airplanes, two bomb salvo handles provide a selective mechanical

release of bombs or fuel tanks. The bomb system electrical controls consist of a bomb release switch on top of the control stick, and three bomb arming switches and a bomb release selector switch on the armament control panel. The gun sight is adjustable for use in low altitude bombing.

# b. OPERATION.

(1) GENERAL.—The electrical release of bombs is the normal release. The "SALVO" release is used only if the electrical release fails. The two "NOSE ARM" switches arm the nose fuse of the bombs on the left and right racks. The "TAIL ARM" switch arms the bomb tail fuse on both racks. The bomb release selector switch has the following positions: "BOTH," "SAFE," and "SELECTIVE." With the

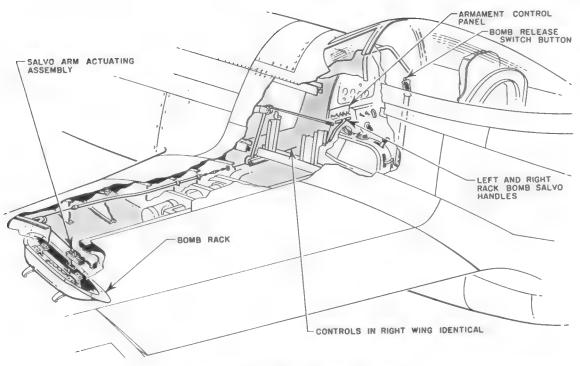


Figure 32—Bomb Rack Control System

selector switch on "BOTH," the bombs will be released simultaneously when the release switch is pressed. When the selector switch is on "SELECTIVE" and the bomb release switch is pressed, the left bomb will be released; when the bomb release switch is pressed again, the right bomb will be released. The bomb release circuit is inoperative when the selector switch is in the "SAFE" position.

### NOTE

Bombs may be released when the airplane is in any attitude of flight from a 30-degree climb to a vertical dive.

### CAUTION

To prevent bombs from falling into the propeller, do not release bombs when sideslipping more than 5 degrees in a vertical dive.

- (2) INOPERATIVE POSITION OF CONTROLS. —When not in use, the controls shall be positioned as follows:
  - (a) Bomb release selector switch on "SAFE."
  - (b) Nose and tail arming switches "OFF."
- (c) On early airplanes, bomb salvo handle with antisalvo guard down.

- (3) SELECTIVE RELEASE (ELECTRICAL). To release bombs selectively, proceed as follows:
  - (a) Place arming switches in desired position.

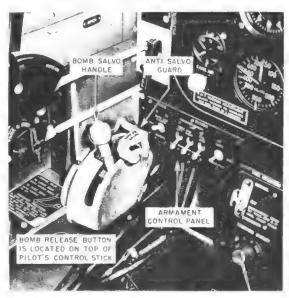


Figure 33-Bomb Controls-Early Airplanes

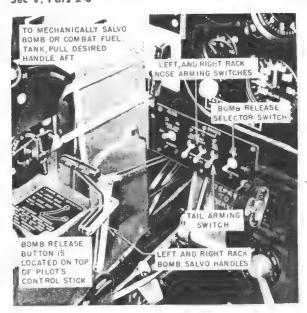


Figure 34-Bomb Controls-Late Airplanes

- (b) Place bomb release selector switch on "SE-LECTIVE."
- (c) Press bomb release switch button momentarily to release bomb on left rack.
- (d) Press bomb release switch button again to release bomb on right bomb rack.
- (e) Bomb arming switches "OFF," bomb release selector switch to "SAFE."
- (4) SALVO RELEASE (ELECTRICAL).—To release both bombs simultaneously, proceed as follows:
  - (a) Place bomb arming switches in desired position.
  - (b) Place bomb release selector switch on "BOTH."
- (c) Press bomb release switch; both bombs will release.
- (d) Bomb arming switches "OFF," bomb release selector switch to "SAFE."

# NOTE

For emergency bomb release instructions, see Section IV, paragraph 6.

# 3. COMMUNICATION EQUIPMENT.

a. GENERAL.—Radio equipment consists of a command set and an identification set. The command radio may be either SCR-522 or SCR-274-N. Identification equip-

ment may be either SCR-695 or SCR-515. Additional communication equipment includes a signal pistol, a signal lamp, and recognition lights.

# b. COMMAND SET SCR-522.

(1) DESCRIPTION.—This set is a push-button type of transmitter-receiver, operating on the 100 to 156 mc band (see figures 36 and 37). The control box is just aft of the right-hand switch panel in the cockpit. A transmit-receive, remote control button is on the throttle lever. Lamps adjacent to the control buttons indicate which band is being used. A remote contactor, on the left side of the instrument panel, switches the transmitter from any of the four voicemodulated bands to the tone-modulated "D" band for 14 seconds of every minute. The pointer on the face of the contactor indicates when the switch's action will take place. The clock switch on the contactor should never be touched in flight; it is set on the ground by the service crew. A separate receiver, located on the floor at the pilot's right, is installed with this equipment for use in the reception of beacon signals, weather broadcasts, and airport communica-

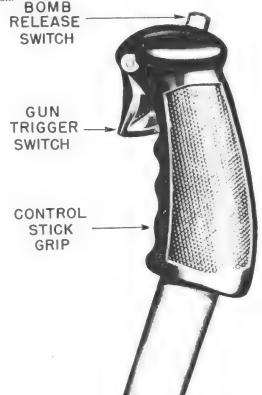
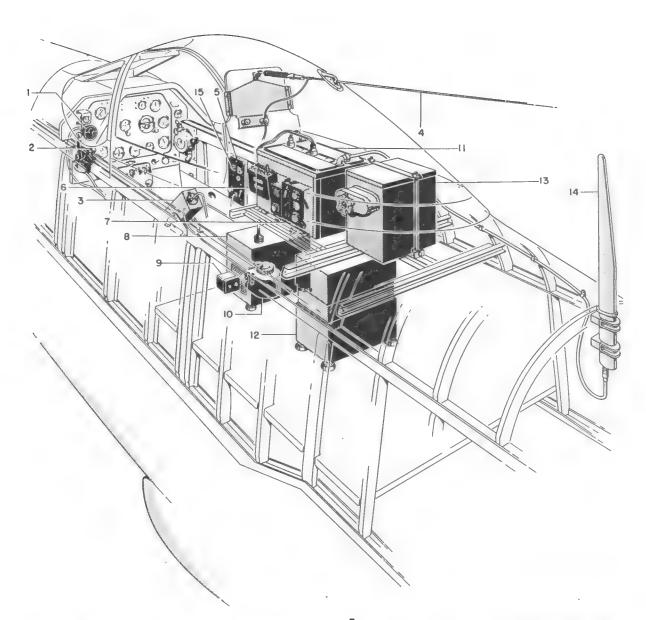


Figure 35—Gun and Bomb Control Switches



I.REMOTE CONTACTOR

2.THROTTLE SWITCH

3.DETROLA RECEIVER SCR-438

4 DETROLA & SCR-274-N ANTENNA

5.106-71154 PANEL ASSEMBLY

6. CONTROL BOX SCR-522 7. CONTROL BOX SCR-695

8. POWER SUPPLY SCR-522 9. INDICATOR LAMPS SCR-695

10.INERTIA SWITCH SCR-695

II.TRANSMITTER RECEIVER SCR-522

12. RADIO SCR-695

13. BATTERY

14. ANTENNA SCR-522

15. SCR-695 DETONATOR BUTTONS

Figure 36-SCR-522 and SCR-695 Radio Equipment

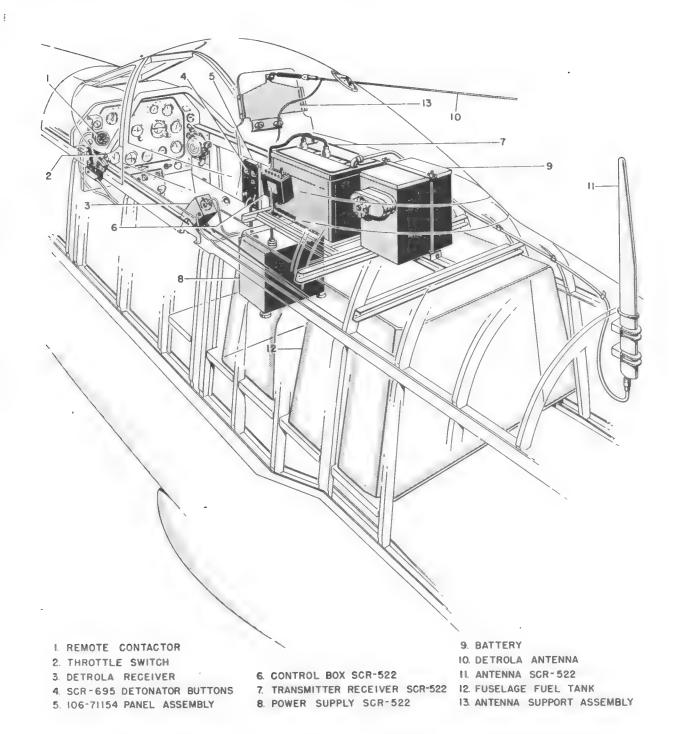


Figure 37—SCR-522 Radio Equipment (On Airplanes With 85 Gallon Fuselage Tank) RESTRICTED

# (2) OPERATION.

# (a) TRANSMISSION.

- 1. Push button "A," "B," "C," or "D," depending upon the band to be used.
- 2. Allow set approximately one minute to warm up and, during this time, check contactor operation with switch in "OUT" and "IN" positions.
- 3. Transmit by pushing toggle switch at aft end of control box to "T" (transmit) position. To send an uninterrupted message, place contactor switch in "OUT" position.

# NOTE

The lever just forward of the transmit-receive toggle switch controls the momentary or permanent action of the switch. A similar lever at the forward end of the control box regulates the brightness of the indicator lamps.

- 4. Move transmit-receive toggle switch to "REM" (remote control) if the remote control button on the throttle lever is to be used. Push button to transmit.
  - 5. To turn set off, press button marked "OFF."

# (b) RECEPTION.

- 1. Turn toggle switch at aft end of box to "R" (receive), or to "REM" if remote control is desired.
- 2. Press button "A," "B," "C," or "D," depending on which band is desired. Allow set approximately one minute to warm up. Reception of a signal will indicate whether the receiver is operating properly.
  - 3. To turn set off, press button marked "OFF."

# NOTE

The auxiliary receiver used with this set is turned on and off by the hexagonal control knob. The round knob is the frequency control.

# c. COMMAND SET SCR-274-N.

# (1) DESCRIPTION.

(a) GENERAL.—This set consists of two transmitters and three receivers with independent controls for each group, an antenna switching relay, and the necessary accessory items for interconnection of the units (see figure 38). The control boxes are mounted at the pilot's right. With the fuselage tank installed, one transmitter and two receivers are installed on the upper radio support, providing a transmitting range from 4000 to 5300 kcs and a receiving range from 190 to 550 kcs and 3000 to 6000 kcs. When

the fuselage tank is not installed, an additional transmitter and receiver may be mounted on the fixed radio shelf, extending the transmitting range from 5300 to 7000 kcs and the receiving range from 6000 to 9100 kcs.

- (b) TRANSMITTER.—The transmitter control box contains three switches, marked "TRANS. POWER," "TRANS-MITTER SELECTOR," and "TONE-CW-VOICE." The switch marked "TRANSMITTER SELECTOR" has four divisions, two of which are used. Markings on the "TONE-CW-VOICE" switch indicate the type of signal being transmitted. With the switch turned to the "TONE" position, a signal is transmitted which is practically 100% modulated at 1000 cycles. With the switch turned to the "cw" position, a "continuous wave" or unmodulated signal will be transmitted. With the switch turned to the "VOICE" position, the microphone will be operative and voice will be transmitted when the push-to talk button on the throttle lever is pressed. For long-range communication, "CW" is most effective, "TONE" next, and "VOICE" least effective. The microphone is inoperative on both the "CW" and "TONE" positions, and code signals may be transmitted by a key on top the transmitter control box. If desired, a separate key may be plugged into the jack marked "KEY."
- (c) RECEIVER.—The receiver control box is divided into three sections. A signal of specific frequency is received by using the section of the receiver control box which controls the particular receiver involved.

# (2) OPERATION.

- (a) TRANSMISSION.—Switch "ON" transmitter power switch, select one of the two transmitters, and turn "TONE-CW-VOICE" switch to the desired position.
- (b) RECEPTION.—Turn on switch in upper righthand corner of the control box section used. This switch, in addition to having an off position, has two selective positions marked "cw" and "mcw," each of which is an on position and indicates the type of signal to be received. To increase the volume of the signal, turn the knob in the lower left corner of the control section in a clockwise direction.
- d. IDENTIFICATION EQUIPMENT.—The identification equipment is controlled from a box aft of the righthand switch panel. For operating instructions, see the communications officer in charge. Detonator buttons and an inertia crash switch are provided with this equipment.

# WARNING

Insert destructor plug only when the airplane is ready to take off. Remove plug immediately after landing.

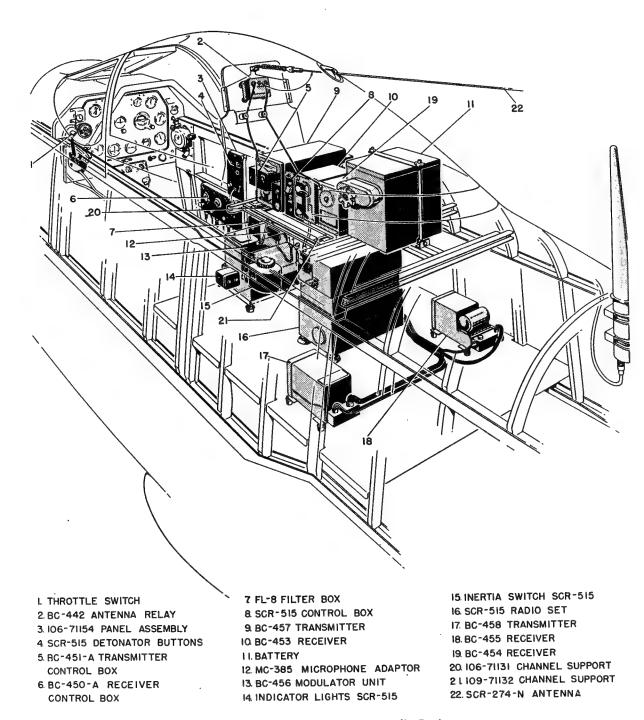


Figure 38—SCR-274-N and SCR-515 Radio Equipment

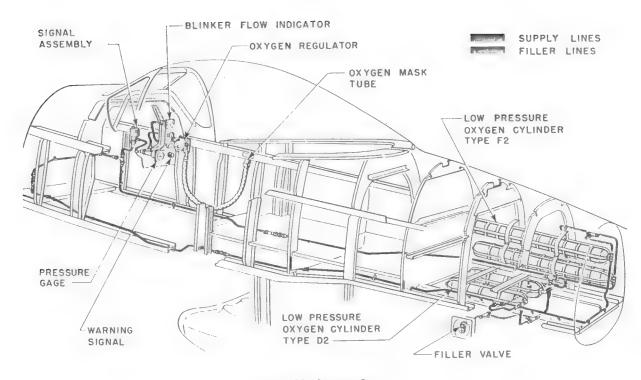


Figure 39-Oxygen System

# e. PYROTECHNIC RECOGNITION SIGNAL PISTOL.

(1) DESCRIPTION. AN-M-8 pyrotechnic pistol is stowed in a canvas holster strapped to the pistol cartridge stowage bag on the upper left longeron, forward of the pilot's seat. A pistol mount is at the pilot's left. A cap, chained to the mount, covers the port when the pistol is not installed.

# (2) OPERATION.

- (a) Remove cover cap from mount.
- (b) Insert muzzle of pistol in the mount so that the lugs on the pistol barrel slip into the slots; then, while depressing the mount release trigger, turn the pistol to right or left as far as it will go.
- (c) To load pistol, press breech lock lever, behind the mount release trigger, and apply force on the butt until the breech opens. Then insert signal into the chamber and close breech. Pistol is cocked automatically when breech is closed.

# WARNING

Do not load pistol except when it is in the mount, since no safety is provided.

- f. SIGNAL LAMP.—A Type AN-3089 signal lamp may be stowed on a bracket on the left side of the cockpit floor. An electrical receptacle for the lamp is located on the extreme upper right side of the cockpit behind the pilot's seat. Colored filters may be used with the lamp.
- g. RECOGNITION LIGHTS.—For operation of recognition lights, see Section II, paragraph 23, a. (5).

# 4. OXYGEN SYSTEM.

a. DESCRIPTION.—Oxygen is supplied from two Type D-2 and two Type F-2 low pressure oxygen cylinders. A Type 'A-12 demand regulator, cylinder pressure gage, low-pressure warning signal, and flow indicator are in the cockpit (see figure 39). A Type A-9, A-9A, A-10, or B-14 mask may be used with this equipment. The blinker flow indicator operates with the breathing of the wearer, indicating proper functioning of the system. When the pressure of the cylinders drops to the danger point (100 lbs./sq. in.), a signal lamp on the instrument panel illuminates. The oxygen cylinders may be refilled without removal from the airplane by means of a filler valve on the left rear side of the fuse-lage. Normal full pressure of the system is 365 lbs./sq. in. See figure 40 for oxygen consumption chart.

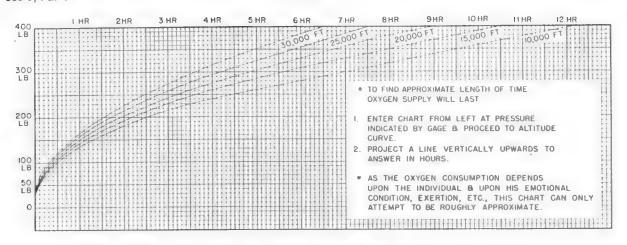


Figure 40-Oxygen Consumption Chart

# b. OPERATION.

# (1) PREFLIGHT CHECK.

- (a) See that mask is properly fitted and check for leakage by holding the thumb over the corrugated hose fitting and inhaling normally. See that mask is clean.
- (b) Check mask fitting to see that gasket is in place; then insert fitting into the end of the tubing from the regulator. Be sure the fit is snug and that a pull of at least 10 pounds is required to separate the two.
- (c) Inspect mask regulator tubing for damage. Make sure all clamps are firmly in place.
- (d) Attach the spring clip on the tubing to the clothing or parachute harness high up on the chest. It may be desirable to sew a tab of fabric or webbing to the cloth-

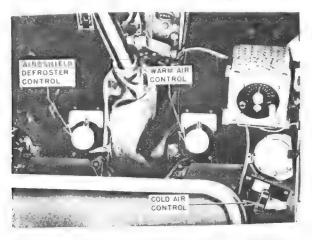


Figure 41—Heating, Ventilating, and Defrosting
Controls

ing to accommodate the clip. Be sure that the attachment is high enough to permit free movement of the head without kinking the mask hose.

- (e) Make certain the knurled collar at the outlet end of the regulator is tight. Examine top diaphragm to see that it is not ruptured or distorted.
- (f) Turn emergency knob "ON" to check the flow. Check the pressure gage to see that there is no perceptible pressure drop. Turn emergency knob "OFF" and ascertain that it does not leak. Leave it in this position.
- (g) Turn the auto-mix to "OFF." Note on flow indicator that on inhalation the top diaphragm goes down and that nearly 100 percent oxygen is received. Turn the auto-mix to "ON" and note that there is little or no indication of oxygen flow on the indicator. Leave in this position.
- (b) Check that pressure of the system is not less than 365 lbs./sq. in. Before take-off, make certain that the pressure gage shows sufficient oxygen supply for the mission.

# (2) DURING FLIGHT.

- (a) If ice forms on mask, manipulate the mask at regular intervals to free it from ice.
  - (b) Be sure hose does not become kinked or twisted.
- (c) If a lack of oxygen is experienced, turn "ON" red emergency knob on regulator.
- (d) Check pressure gage and flow indicator frequently.
- (e) In any flight over 30,000 feet, pay particular attention to oxygen equipment. Be sure all units and instruments are functioning perfectly before attempting flight

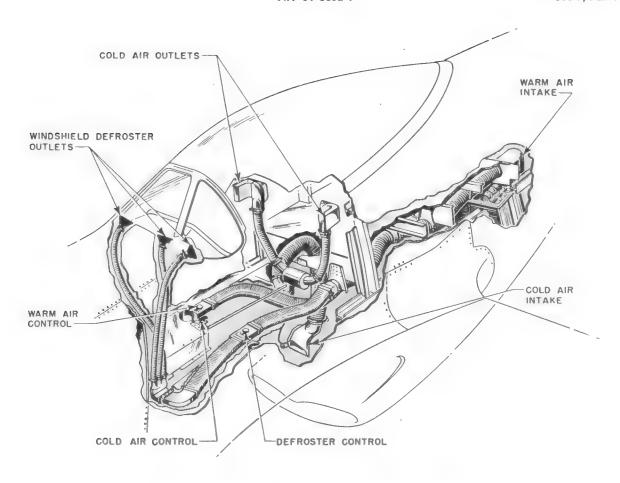


Figure 42—Heating, Ventilating, and Defrosting Systems

to extremely high altitudes. Any failure of the equipment may be fatal.

# (3) AFTER FLIGHT.

- (a) Be sure all oxygen equipment is in proper condition before leaving airplane. If any difficulties have developed during flight, take necessary steps to have them corrected.
- (b) If oxygen pressure is below 100 lbs./sq. in., see that the supply warning light is on. If the pressure is slightly above 100 lbs./sq. in., bleed oxygen out of sys-

tem by turning red emergency knob to "ON" and see that the supply warning light goes on at about 100 lbs./sq. in. Turn emergency knob to "OFF."

(c) Wash mask with mild soap and water, dry thoroughly, and leave in a clean airy place out of the sunlight.

### NOTE

The oxygen mask will not stand abuse. See that the mask is properly stored or hung up in the airplane when not in use. Exposure of the mask to sunlight causes rapid deterioration.

# OPERATIONAL EQUIPMENT Sec V, Par 5

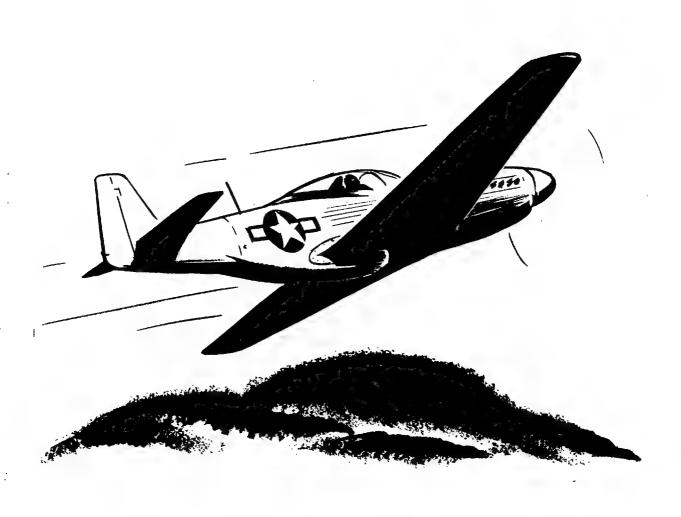
# RESTRICTED AN 01-60JE-1

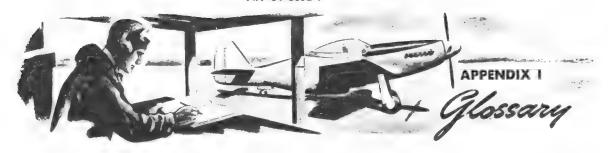
# 5. HEATING, VENTILATING, AND DEFROSTING SYSTEM.

a. COCKPIT HEATING AND DEFROSTING.—Warm air from aft of the coolant radiator is utilized to heat the cockpit and to defrost the windshield and left side window (see figure 42). The cockpit hot air control is on the floor at the right of the control column; the defroster control is on the floor at the left of the control column.

To admit warm air turn desired control to the right, to-ward "ON."

b. COCKPIT VENTILATION.—Air from the forward section of the radiator air scoop is used to cool the cockpit. The cold air control is on the floor at the right side of the pilot's seat. Cold air outlets are located behind the pilot's seat.





AMERICAN TERMINOLOGY	BRITISH TERMINOLOGY
Accumulator	
Battery	Accumulator
Carburetor	Carburettor
Cockpit Enclosure	Cockpit Hood
Control Stick	Control Column
Empennage	Tail Unit
Engine (Power Plant)	Aero-Engine
Firewall	Fireproof Bulkhead
Indicated Airspeed	Air-Speed-Indicator Reading
Land	Alight
Landing Gear	Undercarriage
Left	Port
Lines	Pipes
Manifold Pressure	Boost
Mooring Rings	Picketing Rings
Radio	Wireless
Right	Starboard
Shock Strut	Oleo Leg
Surface Control Lock	Locking Gear
Surface Controls	Flying Controls
Windshield	Windscreen
Wing	Main Plane



RESTRICTED



# 1. FLIGHT PLANNING.

# a. GENERAL.

(1) A series of charts on the following pages is provided to aid in selecting the proper power and altitude to be used for obtaining optimum range of the airplane. Charts are provided for each airplane configuration with the probable ranges of gross weights.

### NOTE

Two sets of Flight Operation Instruction Charts are provided. The first set of charts (figures 44 through 50) is applicable to airplanes with V-1650-7 engines; the second set (figures 51 through 57) applies to airplanes which have had V-1650-3 engines installed in service.

(2) It the flight plan calls for a continuous flight where the desired cruising power and airspeed are reasonably constant after take-off and climb and the external load items are the same throughout the flight, the fuel required and flight time may be computed as a single section flight. If this is not the case, the flight should be broken up into sections, and each leg of the flight planned separately, since dropping of external bombs or tanks causes considerable changes in range and airspeed for given power. (Within the limits of the airplane, the fuel required and flying time for a given mission depend largely upon the speed desired. With all other factors remaining equal in an airplane, speed is obtained at a sacrifice of range, and range is obtained at a sacrifice of speed.)

# b. USE OF CHARTS.

- (1) Although instructions for their use are shown on the Flight Operation Instruction Charts, the following expanded information on proper use of the charts may be helpful.
- (2) Select the Flight Operation Instruction Chart for the model airplane, gross weight, and external loading to be used at take-off. The amount of gasoline available for flight planning purposes depends upon the reserve required and the amount required for starting and warm-up. The fuel required for warm-up and initial climb is set forth on

the chart. Reserve should be based on the type of mission, terrain over which the flight is to be made, and weather conditions. The fuel required for climb and time to climb to various altitudes is shown on the Take-off, Climb, and Landing Chart. Fuel remaining after subtracting reserve, warm-up, and climb fuel from total amount available is the amount to be used for flight planning.

- (3) Select a figure in the fuel column in the upper section of the chart equal to, or the next entry less than, the amount of fuel available for flight planning. Move horizontally to the right or left and select a figure equal to, or the next entry greater than, the distance (with no wind) to be flown. Operating values contained in the lower section of the column number in which this figure appears represent the highest cruising speeds possible at the range desired. It will be noted that the ranges listed in column I are correct only at sea level and are conservative for higher altitudes. The ranges shown in column II and other columns to the right of column II can be obtained at any of the altitudes listed in the Altitude column. All of the power settings listed in a column will give approximately the same number of miles per gallon if each is used at the altitude shown on the same horizontal line with it. Note that the time required for the flight may be shortened by selection of the higher altitudes. In long-range cruising it is important that altitude, airspeed, and rpm be held constant. The manifold pressure should be changed as required to hold the above values reasonably constant. The flight duration may be obtained by dividing the true airspeed of the flight altitude into the air miles to be flown.
- (4) The flight plan may be readily changed at any time en route, and the chart will show the balance of range available at various cruising powers by following the Instructions for Using Chart printed on each chart.

# **IMPORTANT**

The above instructions and following charts do not take into account the effect of wind. Adjustments to range values and flight duration to allow for wind may be made by any method familiar to the pilot, such as by the use of a flight calculator or a navigator's triangle of velocities.

RESTRICTED 5



19' 1615 19' 1615 VM-H-0		AIRPLAN P-5	ᇤ믦	MODELS	SIS		=	I I	OFF,	CEM	4	TAKE-OFF, CLIMB & LANDING CHART	5	CHAN	E		<b>T</b>	GINE	ENGINE MODELS	SIS	
3040 300 1001						1		T	TAKE-0	W.	DIST	DISTANCE (NRET)	E	<b>HET</b> )				V-1650-	0-7		
0000	┝	MEAD WORD	_	¥ H	MARD SU	SURFACE RUNWAY	NO.	YAY			1	OD-TURE RUNWAY	NON	WAY		_	SOFT		SURFACE RUNWAY	N WAY	
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	ğ	MAT 1A.S.	1/1000	N N	MET LAS	77/1848	NEW TO S	FURL PROM S.L.	Te a	1.A.S. PT/M	- 5	FUEL PROM S	11 BEST	1.4.1.	FIAME PROM	FUEL PROSE S.L.		1.A.S. PT/18398	and a	FUEL FROM S.L.	Clares
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i E	Ē	**			2 0 E	-		_	$\rightarrow$	70 CIEAR 98 30' 08J.	NOT NOT	10 CLEAR 50' OBJ.	BOLL	TO CLEAN SO' COL.	BOUT BOUT	TO CLEAR SO' OBJ.	BOL BOL	36' 08.	BOUL BOUL	TO CLEAR SO, ORL	BOLL BOLL
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REMARKS		9000 POUNDS 13 MIT 10,000 AND 11,000 OR EXTERNAL TANKS.	DODO POURDS 19 KITE NO EXTERNAL 15AD 16,000 and 11,000 Pourds are kith Bod De external tarks.	ETTERNAL B ARE VI	TE NO EXTENDAL LGAD POUNDS ARE VETI DOMBS													1.2.1. Indicated Air Speed Air Linding No From 15.1. E. E. Ballen 18.2. I. E. Ballen 18.3. I. E. Ballen 18.3. I. Ballen 18.3.	Indicated Ata Speed Miles Per Hour See Level U. S. Garline Imperial Gallers All Distances are Are SURES HAVE NOT 8	eroge EEN FLIGHT	CHECKED

Figure 43-Take-off, Climb, and Landing Chart

TEMS	····		NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a	Bacrifice in speed. Manifold pressure (M. F.), gailons per nour	for reference. For efficiency maintain indicated airapeed	(I. A. S.) hourly. Adjust RPM slightly if necessary to avoid ex-	tė	A		KANGE IN AIR MILES	NAUTICAL	1100	. 960	830	089	550	420		280	140	MAXIMUM RANGE	HIX. N. P. G. T. TURK No. R. P. A. R.		A.B. FT 62 360	: 1:	70 13		42	AL 33 39	AL 31 34 200	LEGEND  R. P. MANTOL PRESENT  R. P. MANTOL PRESENT  C. P. TOTAL STREET SHOW  C. P. TOTAL STREET  R. S. L. SATOLEAN  R. S. L. SATOLEAN  R. S. S. SATOLEAN  R. S. SATOLEAN  R. S. S. SATOLEAN  R. S. SATOLEAN
EXTERNAL LOAD ITEMS	WING BOMB RACKS		ergency high a progressive inc	ressure (M. F. T. A. S.) ere	ney maintain	M slightly if ne	re than 3 in. H			KANGE	STATUTE	1270	1110	026	780	0119	08 tr		350	<u></u>	XYM	R. P. M. L. A. S.	-	2550 205	2 5	34.4		1650 210	1600	1600 200	LALE POPULATED ARRESTED  M. F. MARTICLE PARRIES  T. A. E. G. M. E. MARTICLE  T. A. E. M. M. E. MARTICLE  A. L. SAL MARTICLE  R. L. SAL LARE MORT  R. L. SAL LARE MORT  R. L. SAL LARE MORT  SAL MARTINE  SAL MARTINE
EXTE	N F A		for em V give	d police	ficie	ust RP	ure mo		FUEL	si i	ij	268	210	180	20	120	۶		8	ဓ		ALT. Feet	40000	\$5000	20000		15000	10000	2000	S.L.	CONCATE  ANTIPOLE  RUE ARE  EA LEVE  ED FIG  F TO RE
				ce in speed. Man	ference. For ef	S.) hourly. Adj	ceeding manifold pressure more than 3 in. Hg.	.			NAUTICAL	970	850	730	019	180	360	1	240	120	DATA	1 日本		,	-		FT 61 315	36 57 295		36 48 250	LARIN PRESENT C. P. M. I T. A. E. I R. E. I BUBJEC
N CHART		N		_				ř	*	RANGE IN AIR MILES		IN FLIGHT	080	Office	200	560	#50		280	0#1	OPERATING DATA	R. P. M. L. A. B. MDs.		ì	2	2	2350 245 AL 2150 250 AL	2150 250 AL	2150 250 AL	2150 250 AL	240 CALOFFUEL CES OF 28 GAL) 20.000 FT. ALT MPH IND ARSPEED
STRUCTIO			I: Select figure in FUEL fuel to be used for cruising.	lect RANGE value	air miles to be now sing altitude (AL?)	RE setting required				R MILES	_	AVAILABLE I	720	610	510	410	310		200	100	5 DATA	2. 1 2. 1 2. 1 3. 1 3. 1 4. 4		:	3 1	380	39 78 340 2150	38 73 315	38 66 290	38 63 270	240 NCES 01 20.00
ERATION IN		IMITS: 9600	INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising.	Move horizontally to left or right and select RANGE value equal to	or greater than the statute or nautical air miles to be nown. Yer- tically below and opposite desired cruising altitude (ALT.) read	optimum R. P. M., I. A. S. and MIXTURE setting required.			=	RANGE IN AIR MILES		ALLOWANCE NOT A	830	710	280	470	8	£	230	0 =	OPERATING DATA	R. P. M. L. A. S. MIX.		-	G 5	760	2600 270 AK 2400 270 AR	2400 270 AR	2400 270	2400 270 AR	AT 9400 IB CROSS N. WITH IATER REDUCTIVE OF ALL ALLOWS TO FLY 1000 STAT ARBHILES AN MAINTAIN 2350 REM AND 245 WITH MIXTURE SET AUTO LEAR
FLIGHT OPERATION INSTRUCTION CHART		CHART WEIGHT LIMITS:	INSTRUCTIONS	Move horizontally	or greater than the	optimum R. P. M.,		-		RANGE IN AIR MILES	NAUTICAL	GAL. ALLOW	620	530	740	350		<b>€</b> 2.	027 .	06	OPERATING DATA	MOX. 16. 7. 4. TURE 16. 17. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4.					AR FT 97 365	AR 43 88 335	#3 82	AR 43 77 290	CCLIMB REGOD SERVICE, MARM-UP, K UNTIL AT LERST G TANKS. DM LY.
			TIME TOTAL	181	178	1	<b>cont.</b>		H	RANGE IN	BTATUTE	J 29 (	720	910	510	017	300		200	001	OPERAT	R.P.M. LAS.	+		+		2550 290	2500 285	285	2550 285	OFF A INITIAL CLIM A COMBAT AS REGI ISTALLED AND SER USELAGE TANK UN HING TO NING TA
			MIXTURE T	AR	<del>                                     </del>	Ť	AR CO		FUEL	o.s.	GAL.	598	012	8	150	120	8	,	8	30	t	ALT. Feet R	4000	35000	3000	25000	20000	10000			NOTES R WARM-UF, TAKE-OFF A IN WIND, RESERVE A COM LAGE TARK IS RESTALL AND CRUISE OF EUSEL ED BEFORE SMITCHING R ABOVE HEAVY
MODEL(S)	) ;	V-1650-7	8 8	<u> </u>	3	3 S. S.	_		<u> </u>		NAUTICAL	590	510	077		280	220		140	20	NTRINDODS	1144		FT 80 400	FT 105 420	146 115 410	F1 100 390	108 355	46 103 330		NOTES  TALLOW 2.8 CAL FOR WAREHUT, TAKEOFA INTIAL CLIMB PLUS ALLOWANCE FOR WHICH, RESERVE & COMBATAS REGIO  2. IF 85 GALLOW FUSELAGE TARK IS INSTALLED AND SERVICEC, MARH-UT ALCOFF, CLIMB, AND GRIES OF RESELGE TRAK WITH AT LEAST TAKE-LOFS ARE USED REFORE SHITCHING TO WING TAKES  HIGH BLOWER ABOVE HEAVY LINE DRIVY.
	. ·	ENGINE(S):	×	WAS 3000	1	+	RATED 2700		1	RANGE IN AIR MILES	STATUTE	089	280	015	120	οπε	250		170	80	MAXIMUM CONTINUOUS	R. P. M. L. A. B. MIN-			265	$\dashv$	2700 290 AR 2700 305 AR	2700 30E AB	305	305	C ALLO PLUS 2. IF 81 17 KF 50 G

Figure 44—Flight Operation Instruction Chart—V-1650-7 Engine (Wing Bomb Racks—9600 to 8000 lbs.)

22	OMBS		e in range at a	allons per hour	icated airapeed	ary to avoid ex-			AIR, MILES	NAUTICAL		. 1080	086	900	\$10	720	630	M RANGE	MACC. 16. P. A. T. T. T. T. T. T. M. T. M.			AL FT 53 295	8t Li	$\neg$	FT #2	33 39	2	T. T
EXTERNAL LOAD ITEMS	- 300-LB. WING BOMBS (OR SMALLER SIZE)	1	NOTES: Column I is for emergency fight speed crushing only. Columns II, III, IV and V give progressive increase in range at a	sacrifice in speed. Manifold pressure (M. F.), gallons per nour	(b. F. H.) and the amples (t. A. B.) are approximate years. for reference. For afficiency maintain indicated atrapeed	(I. A. S.) hourly. Adjust RPM slightly if necessary to avoid ex-	then 3 in. Hg.	Α	RANGE IN AIR, MILES	STATUTE		1240	0111	0201	930	830	730	MAXIMUM RANGE	R. P. M. L.A.S. MI			2100 200 A	200	1800 200 A	205	205		LA S. HORATE ARREST  LA S. HANTOLD PERSON  C. P. H. C. L. PERSON  C. P. H. S. C. L. PERSON  C. L. H. M. ALTER  R. L. H. M. ALTER  B. L. C. L. CHURK  B. L. H. M. ALTER  B. L. C. L. CHURK  B. L. H. M. ALTER  B. L. C. L. CHURK  B. L. H. M. ALTER  B. L. C. L.
EXTERN	- 300-LB.		give pr	Told plan	icien	st RPM	Te more	FUEL	c s	GAL.	269	240	220	200	180	9	0 tr 0	H	ALT. Feet R.	40000	30000	25000 2	_				1,2	A CAL PER UR AIRPEL A LEVEL TO PERVI
-	8		Column I is I	n speed. Mani	) and true aura	hourly. Adju	ceeding manifold pressure more than 3 in. Hg.	Ŀ		NAUTICAL G	Θ.	930	850	270	630	620	240	VTA .	2 년 1 년 1 년 년 1 년 년			37 71 350 2	67 330	FT 63 310	59 290	25	36 51 250	LA A: 200 LA A: 104 C. P. A. U. U. T. A. E: 704 S. E. S. SE REI REI REI
			NOTES:	crifice i	1 2	A.S.	eding n	24	AIR M	ž								OPERATING DATA	35			AR	_	=	¥	₹ :	۲	
FLIGHT OPERATION INSTRUCTION CHART		5					8		RANGE IN AIR MILES	STATUTE	FLIGHT	020	066	068	900	012	820	OPERA	T Y B			235	042	245	250	250	250	OF FUEL  CAL.)  FT. ALT.  INSPEED
Z	i : ;	8	INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising:	Move horizontally to left or right and select RANGE value equal to	or greater than the statute or nautical air miles to be flown. Yer- tically halow and conneits desired contains altitude (ALT) read	, p	.		×	STAT	N N	2			~	,-	•		- H			2400	2400	2200			2300	4 84 5
ST 10		9500	figure 1	E value	Post for	require		-		.,									444			375		330	_		260	ANCES O AT 10.00
2			Select to be u	RANG	miles to	anting Acting			ILES	NAUTICAL	AVAILABLE	790	730	999	290	530	160	ATA	2 4 2 E	_		41 86	FT 83	39 78			38	EXAMPLE LB GROSS WT. WITH 240 TING TOTAL ALLOWANCES OF STAT. AIRMILES AT 10,000 O RPM AND 250 MPH IN.
SZ		10,000	[ART: t of fue	nd select	ical air	CTIRE		Ħ	N AIR M					_				OPERATING DATA	X III			AR	AR	¥	¥	A.	¥	ING TOTAL
8		<u>.</u>	ING CH	right a	or naut	ueatren			RANGE IN AIR MILES	E	TON	016	0118	780	980	010	530	OPERA	LAS.			255	260	260	260	260	260	25 B CC
RAT		MITTS:	INSTRUCTIONS FOR USING CHART: column equal to or less than amount of fuel	o left or	or greater than the statuts or nautical air miles to be flown.	treatly below and opposite desired transmig southers (activity)			_	STATUTE	GAL. ALLOWANCE NOT	a	, <u>s</u>	1	8	•	KO		R. P. M.			2450	2550	2400	2400	2400	2400	AT 9800 IAFTER DE TO FLY (O MAINTAIN
OPE		CHART WEIGHT LIMITS:	IONS F I to or b	ntaily t	nan the	D M d		-		_	AWO.			<del>                                     </del>	<u> </u>				H 4 #					350		-	275	
높		r wei	RUCT) in equa	horizo	eater ti	o a			837	NAUTICAL	ALL	880	620	570	510	450	400	2	1 4 K	_		H	-	FT 96			42 75	TAKE-OFF, SO GALLON
FLIG		CHAR	INST colun	Move	10.5	Config		=	RANGE IN AIR MILES	NA	GAL.						_	OPERATING DATA	MIX. P. TURE In. Ture	-		l		A.R.			AR.	
		_	TOTAL G. P. H.	ž :	-	20	800	[	NGE IN	E	83				0		0	PERAT	LAS.					280	280	275	275	TALCLIMS TARCO. TARRESTO TARRE
			TIME 1	9	1.	- -	CONT.		2	STATUTE	-	780	720	920	280	520	09 <del>1</del>	ľ	R. P. M.		_			2550			2500   2	NOTES  WARH-UP, TAKE-OFF A INITIA OR WIND, RESERVE & COMBAL'S ELAGE TAK IS INSTALLED, OR IVESEERGE TAKE UNTIL SHITCHING TO MING TAKES, ABOVE HEAVY LINE
					$\vdash$	+	3	12	9/3	   ਜ	0		2	9	081	180	₽	ł	ALT. Feet R.	40000	30000	8	20000	15000 2	10000		S. L. 2	ESENCE TAKE OF
			MIXTURE POSITION	7	'	3	3	FUEL	E	GAL	209	240	220	500	=	=	_	╀	F44	\$	8 8	395 25000	375 20	365 15			295	NOTES WARM-UP. WIND, RE AGE TANK ON FUSEL ITCHING
MODEL(S)	<u> </u>	0-7	BLOWER POSITION	3	3	<b>8</b>	3=			TCAL		560	0	0	0	0	0	80				==	8 -	=	108	503	88	AL. FOR ACE FOR FUSEL,
MOM C	Ĺ	V-1650-	M. P. BLOWE (Df. HG.) POSITIO	2	1	=	2		RANGE IN AIR MILES	NAUTICAL		26	510	470	420	370	330	TINDO	F 4 E		_	9#	1-	9+	_		<b>9</b>	NOTES  D. ALLOW 28 CAL FOR WAND, TAKE-OFF A INITIAL CLIMB PLUS ALLOWANCE FOR WAND, RESERVE & COMBAL, AS RECORD THE INSTALLED, MARH-UP, CALINB, AND CRISTS OF PUSELGE THE WORLLE I EAST ARE USED REFORE STITCHING TO WING THESE.  HIGH BLOWER ABOVE HEAVY LINE ONLY.
			R. P. M.	9008	1	88	27.00	-	E IN AD	-	-		_	+-	,	10. 1 Sec. 19		UM COX	XIX	1	•-	# W	I_	A.R		*	¥	PLUS. FLISS CLINB AME U
		ENGINE(S):	_		+-				RANGI	STATUTE		920	280	0 <del>1</del> 10	₩	) #30	380	MAXIMUM CONTINUOUS	R. P. M. L. A.S.	_		270	1	230			230	7 A
		ENG	LINE	NA.		POWER	MATED			Ţ		~							R. P. M			2700	2700	2700	2700	2700	2700	

Figure 45—Flight Operation Instruction Chart—V-1650-7 Engine (Two 300-lb. Wing Bombs—10,000 to 9500 lbs.)

SE	BS	ed cruising only.	se in range at a	granding per more	dicated airspeed			RANGE IN AIR MILES	NAUTICAL		/40	650	. 550	160	370	280	190	100	MAXIMUM RANGE	MERC N. P. 4. TURE N. P. 4.			AL FT 52 305	AL FT 49 285 AL FT 45 260	AL FT 42 245	33 40	AL   32   37   210	F.T. PULL THROTTLE F.R. PULL RICH A.E. AUTO-RICH C.L. CRUBING LEAN	INARI.
external Load Items	300-LB. WING BOMBS (OR SMALLER SIZE)	Column I is for emergency high speed cruising only.	Columns II, III, IV and V give progressive increase in range at a	racrince in speed. Manifold pressure (M. F.), gaining per mount (G. P. H.) and true airspeed (T. A. S.) are approximate values	for reference. For efficiency maintain indicated airspeed	(I. A. S.) nourly. Audust Mr sugarily in neces-		RANGE IN	BTATUTE		820	0117	0119	530	0En	320	220	011	MAXIM	R. P. M. L.A. B.			2100 205	2050 205	1650 210 /	1600 210	1600 210	LAS, ROICATO ARRESTO LAS, ROICATO ARRESTO THE ARRESTO T. P. M. U. C. C. PERSON T. A. S. TRUE ARRESTO T. S. S. TRUE ARRESTO T. S. TRUE ARRESTO T. S. TRUE ARRESTO T. S. TRUE ARRESTO	RED FIGURES ARE PERLIMINARY. SUBJECT TO REVISION AFTER FLIGHT CHECK
EXTER		for eme	V give p	apeed (T	ficien	HITE INOT	FUEL	Si Si	GAL.	₹8 	160	유	120	8	90	9	Ş	20		ALT. Feet	40000	30000	25000	20000	10000		8. L	NDICATED LANIPOLD I. B. CALL P BUZ AIRE EA LEVEL	T TO RE
	0	at I um	par A	true air	For ef	d press	Ĩ		VT.											pi al ad			1 355	66 330 62 310	8 290	54 270	50 250	44944	BURUEC
		Colum	H.		ence.	nenifo		II.ES	NAUTICAL	θ	620	240	460	390	310	230	150	70	ATA		$\vdash$		37 71	FT 66 FT 62	36 58	36 5	36  5		
		NOTES	olumns	P. H.	r refer	eding 1	ΙΛ	RANGE IN AIR MILES	N	<u>.</u> -		_	_						OPERATING DATA	TURE			AR	4 F	¥	¥.	Ą		
<b>JAR</b>	POTINTIES				-	2 8		INGE D	35	FLIGHT	0	630	240	150	360	270	081	8	OPERA	L.A.S.			240	240	250	250	250	OF FUEL CAL.) FT. ALT IRSPEED	
OPERATION INSTRUCTION CHART	•	SART WEIGHT LIMITS: 8000 10 8000 1	INSTRUCTIONS FOR USING CHARIS: Select lights in FORM column equal to or less than amount of fuel to be used for cruising.	Move horizontally to left or right and select RANGE value equal to or consists than the statute or nautical air miles to be flown. Ver-	tically below and opposite desired cruising altitude (ALT.) read	<u>.</u>		2	BTATUTE	IN FL	720	62	மி	ä	ě	2	Ξ	_		F. P. M.			2400	2400	2250	2250	2250		
<u></u>			d for ca	value e e flown	(ALT	daire		<u> </u> 							-			_	+	6: 세 m			375	355	305		260	ENAMPLE ENAMPLE CROSS WT. WITH 160 C. VIG TOTAL ALLOWANCES OF STAT AIRMILES AT 16,000 ANTAL TEXT	
20.	٤	2 12	be use	ANGE es to b	Ititude	ting n		22	NAUTICAL	VAILABLE	520	760	390	330	260	190	130	09	L	0 E zi			88	#8 7-2	73	29	62	EXAMPLE LB GROSS WT.WITH 160 STAT AIRMILES AT 16.01 SO RPM ADD. 250 MPH	LEAN
STR		ě	fuel to	elect R.	ising	KE Se		E MOT	MAU	VAII	ŀÕ	7	60	eu	2	7	7		GDAT	A H			<del>-</del>	39	88		38	EXA ROSS W TOTAL.	NO.
Z			unt of	t and a	To pa	optimum R. P. M., I. A. S. and MIXTURE setting required.	Ħ	RANGE IN AIR MILES	-	۲.					-			_	OPERATING DATA	M T	L		¥	AR AR	¥		- AR	1 15 8 :	WITH MIXTURE SET AUTO LEAN
ē	ه د	. L	A BETT	or righ	te desir	S. and		RANG	BTATUTE	GAL. ALLOWANCE NOT	600	530	¥50	380	300	220	- 30	70	6	LAS	_		0 255	260	260		0 260	AT 9300 FAFTER DEDU TO FLY 550 MAINTAIN 5	TH MIXT
ERA	,	9	less th	to left	opposi	. A.:	ļ		15	ANC										R. P. M.	L		2450	2550	2400		2400	្ត្រី	3
		CHART WEIGHT LIMITS:	TONS al to or	ontally then th	w and	P. M.			وا	LOW								•		F 4 4	-		-	100 350	93 325		80 280		
FLIGHT	Ì	TWE	nn equ	e horiz	ly belo	num R		ILES	NAUTICAL	Y	430	380	330	270	220	160	110	50	¥	<b>2</b>	$\vdash$		╁	ᇤ	13		13		
F	į	CHAR	colu	Mov	tice.	optii	=	A ATR M	×	GAL.					-				OPERATING DATA	i i			1	AR	4		ox ≪	. ∀.	
		-	TOTAL G. P. H.	194	178	60 J		RANGE IN AIR MILES	E	ನ	_	_		•				0	OPERA'	I A B			T	280	280	280	280	VOTES  VILON 24 CAL FORW. RESERVE & COMBAT AS REGIO  PLUS ALLOWANCE FOR WIND RESERVE & COMBAT AS REGIO  HIGH BLOWER ABOVE HEAVY LINE ONLY.	
		Ì	TIME	<b>1</b> 0	2	COMT.		-	STATUTE	-	200	Ott	380	310	250	081	120	90		F P. K	T			2550	2550	2550	2550	OFF & IN	
		- 1.	POSITION L		4	N N	FUEL	a	- i	i	† C	9 9	20	8	8	8	9	20	†	Feet.	00007	30000	25000				1	NOTES RM-LP TAKE IND RESERVE	
_			THE POST	=	ı	ŀ	F	<u> </u>	1	+	_		-		-	-	-		$\dagger$	Fee			395				98 295	ABOVI	
MODEL(S)	2 5	V-1650-7	81.0 W I	3 3 2	3	3			NAUTICAL		370	330	280	230	180	140	08	40	3000	9 K H	—		-15	100 375	000			ALLOW 2 <sup>4</sup> GAL FOR V PLUS ALLOWANCE FOR N	
MOM d		9	K. F.	29	=	3		P MILE	MAG		3)	33	28	23	**	77		•	CTONDO	14	1		9	1 9 t	-1-		9#	W 2ª ALLOWA	
		- 1	H	1	ı		-	TA ME	-	+		_	-		-		+-		- 8	35	_		¥	A A	+	£ 4	¥.		
		ENGINE(S):	R.P. K.	3000	├	<del>!</del>		BANCE IN ATP MITTER	STATOTS		130	380	320	270	210	9	0 =	20	MAXIMUM CONTRIDUODS	14.4			270			290	290	- +	
		ENG	LIMITS	WAR	MILITARY	NORMAL			47.		~	.,,			"				1	R. P. M.			2700	2700	1	2700	2700		

Figure 46—Flight Operation Instruction Chart—V-1650-7 Engine (Two 300-lb. Wing Bombs—9500 to 8000 lbs.)

	ğ 4	MODEL(8) P-51.0	<u> </u>			E	E	Õ	ERA	FLIGHT OPERATION INSTRUCTION CHART	ž	TR	UCT	NO	£	M			2 - 6	ELTERNAL LOAD ITEMS - 500-LB. WING BOMBS	LOAD	BOMB		
>	165	V-1650-7				CHA	RT W	HOH	CHART WEIGHT LIMITS:	10.	10,500	,	To	10,000	POUNDS	NDS								
_=	K. P	BLOWER POSITION	(Df. EG.) POSITION POSITION	TIME	TOTAL G. P. E.	_	STRUC umn eq	TONE	S FOR C	INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising.	HART int of fu	: Sele lel to b	e used	ire in F for crui	CEL sing.	Colum	ე შ	olumn II, IV	is for a	NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a	y high	speed ca	ruising n rang	omly.
	67	5	7	•	184	3	ve bori	zontall,	y to left	Move horizontally to left or right and select RANGE value equal to	and sele	oct RA	NGEV	alue equ	3 2	sacrifa G	e in	peed.	Manifold	cacrifice in speed. Manifold pressure (M. P.), gallons per hour	e (M. P	, galle	nts per	hour
	=	髦	7	=	82,0		ily be	DAR WC	opposit	or greater than the statute of maintain air miles to be mown. Year tically below and opposite desired cruising altitude (ALT.) read	d cruisi	ing alt	itude (	(ALT.)	1 4 E	9 5	ferenc a	no true e. For	effic	(G. F. A.) and true attapped (1. A. S.) are approximate values for reference. For efficiency maintain indicated airapeed	o.) are maintair	approx 1 indice	ted sin	poode
L	2	퍞	AR	CONT.	88	<b>ğ</b> .	unun	R. P. M	L, I. A. S	optimum R. P. M., I. A. S. and MIXTURE setting required	IXTOR	E sett	ing req	uired.		ceedin	S.) bo	urly.	Adjust B ressure 1	(I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.	ıtlyif m n 3 in. H	scessary ig.	to ave	id ex-
L			PUEL			=					Ħ					ì			PURI			٨		
•	RANGE IN AIR MILES		c,		BANGE IN AIR MILES	TH ADE	ET III			RANGE IN AIR MILES	IN AIR	MILES	_	_	RANG	RANGE IN AIR MILES	NOTE T		U.S.	L	RANGE	RANGE IN ALT WILES	MILES	_
	MAUTICAL	TCAL	GAL	STA	STATUTE		NAUTICAL	JV.	STA	STATUTE		NAUTICAL	TCAL	8	STATUTE		NAU	NAUTICAL	GAL.		STATUTE		NAUTICAL	TCAL
	240	0	269		1 29 760		. AI	Lo ¥	Z Z	ALLOWANCE NOT		AILA] 760	AVAILABLE 760	и	FL1GHT 1020	T H	G 80	890	269		1180		1020	0
	500	0	220		700		610			800		680	0		Oπe		8	810	, 220		1080		340	
	450	0	200		0119		550			730	_	630	٥		920		740	,	800	_	980		850	
	410	0	180		670		200		-	020		570	0		770		680	0	180		980		770	_
	360	0	091		0 0		440			280		500	0		980		590		5		8		089	
_	320	0	2		0111		390			810		110	0		900	_	520	0		_	089	,	600	_
10	MAXIMUM CONTINUOUS	8			OPERA	OPERATING DATA	V.T.V			OPER	OPERATING DATA	DATA		L	o W	OPERATING DATA	DATA		L		RAX	MAXIMUM RANGE	NGM	
192	MESS. No. 7. TOTAL NO. 7.	<b>电电阻</b> 电电阻	ALT.	R. P. M.	L A. 8.	TURE	<b>电影</b> 电影	# d d	R. P. M.	LAS. KPR.	MOS.	2011年	유 4 m	R. P. M.	LAS	TOWN TOWN	当年期	9 K M	ALT.	R. P. M.	LAB	ACTA Table	* 4 A	Q K M
			30000 30000																30000	0.0.0				
1	AR 46	=	385 25000			T	-	_	2500	245	æ	7	98	365 2400	0 235	×	38	73	345 25000	2150	200	7	٤	55 295
~	AR FT	00 -	364 <b>20000</b> 355 15000	2550	270	av	F.7	340	2600	255	AR	<u>⊢</u>	87 35	350 2450	0 240	¥ .	FT	69 32	325 20000	2100	500	₹ :	<u> </u>	51 275
17	┿	2	130 10000	_	270	A.					¥ W					┿	9 %			-		{	-	
	AR 46	103 305 98 285	2009 38 38 SFL	2500	270	A 4	42 82 42 76	2 290	2400	255	A A		67 27	275 2350 255 2350			36	56 265 52 245				===		
49.7 8 円 [	WOTES  (D. ALLOW 28 CAL FOR WIND, TAKEOFF & INTIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS BGO'D.  2. IF 85-BALLON FUSELAGE THAN IS THSTALLED AND SEVICED. WARDON, TAKE-OFF, CLIMB, AND CRUISE OF SUBELAGE TAN UNTIL AT LEAST SO GALLONS ARE USED BEFORE SITTENING TO MING TAKES.	LE FOR W. CEE FOR W. FUSELAG E-OFF, C ST 50 GA	NOTES AVABLE, TAKEOPE & INITIAL CLIMB MINIO, RETRIVE & COMBAT. AS RECO. 66 TAM 1S INSTALLED AND SEVICED, CLIMB, AND SRUISE ON EUSELGE TAKE ALLORS ARE USED BEFORE SHITCHING HIGH BLOWER ABOVE HE	THE STATE OF A INITIAL CLIMB  THE TAKE OF A INITIAL CLIMB  THE TAKE OF A INITIAL CLIMB  THE TAKE OF A STATE OF ADDICTING TOTAL ALLOW  THE STATE OF AND STATE OF ADDICTING TOTAL ALLOW  TO FLY \$50 STAT ANDHLESA  TO FLY \$50 STAT A	MITIAL CLI MAT AS REC ED AND S ON FUSEL FORE SWI	PAR TANIE	AVY	INE	AT (AFT) TO FL MARIN' WITH	AT 10,300 LB CORNAPLE 240 c. APTER DEDUCTING TOTAL ALLOWANCES OF TOTAL ALLOWANCES OF DATA AIRMITES AT 10,000 MAINTAIN 2300 RPM AND 245 MPH IN WITH MIXTUR SET AND LEAK.	LB. CROSS TING TOT STAT / STAT / O RPM	CROSS WT. WITH CTOTAL ALLOW. TAT AIRMILES A RPW AND 245	1 _ 5 -		L. OF FUEL. 29 GAL.) FT. ALT. AIMSPEED			44444	ENDICATI MANIPOL U. R. CAL TRUE AD BEA LEVY RED FIG	LEGEND FT. PRINTERS AND FT. PULL BY C. L. CHURSH AND	BGEND S PREL	PUCAR PUCAR	P. T. PULL THROTTLE P. A. ATTO-RICH A. L. AUTO-RICH C. L. CHUSSING LEAN MARY INARY IOST CHECK	HECH HECH NG LEA
ĺ							ŀ										ı	l						l

Figure 47—Flight Operation Instruction Chart—V-1650-7 Engine (Two 500-lb. Wing Bombs—10,500 to 10,000 lbs.)

SWS	OHBS		NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a	sacrifice in speed. Manifold pressure (M. P.), gallons per hour	for reference. For efficiency maintain indicated airposed	(I. A. S.) hourly. Adjust RPM slightly if necessary to avoid ex-		<b>A</b>	BANGE IN AIR MILES	NAUTICAL	740	610	520	770	350	270	180	06	MAXIMUM BANGE	MER. N. P. G. T. Y. TURE NG. R. R. R. R.			AL FT 54 300	F. 50	FT #7		AL 35 42 230	3	F. T., PULL THROTTLE F. R., FULL RICH A. R., AUTO-RICH A. L., AUTO-LEAN C. L., CRUTBING LEAN HARY,
EXTERNAL LOAD ITEMS	- 500-LB. WING BOHBS		rgency high spe rogressive incre	essure (M. P.),	o cymaintain in	slightly if neces then 8 in He			EANGE D	STATUTE	800	200	900	200	00 t	300	500	00	MAXIN	EP. IL LAS			2150 200		_	_	1600 210		TACAME AMERICA AMERICA TO TACAME AND TACAME
BX	- 500		for eme V give p	tifold pr	ficien	ast RPk		FUEL	S.S	GAL	<b>₹</b>	000	120	8	99	90	Οħ	20		Port.	40000	30000	25000	20000	15000	10000	200	3	MITOLD IN CALL PARTY ALLEVEL.
	N N		S: Column I is ns II, III, IV and	win speed. Man	erence. For ef	(I. A. S.) hourly. Adjust RPM slightly if nece		-		NAUTICAL	088		077	370	280	220	140	70	DATA	2 4 8 2 4 8			37 73 345	68 325	905	60 285	36 56 265	1 2	LA E. INDECATE ARRESTED  LA E. INDECATE PRISONE  T. A. E. TWU FRIENCE  E. SEA LEVE  RED SPECIFIC RES
N CHART		NS		-	•	•	maan	ΑI	BANGE IN AIR MILES	STATUTE	IN FLIGHT	009	210	¥20	0118	250	170	080	OPERATING DATA	R. P. M. L. A. S. MUS.			2400 235 AR	240	240	245		7390 743 WF	160 GAL OF FUEL VCES OF 24 GAL.) 10,000 FT. ALT. NPH IND. AIRSPEED
FLIGHT OPERATION INSTRUCTION CHART		To 8500	INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising.	Move horizontally to left or right and select RANGE value equal to	or greater than the statute or mattern air maes to be nown. Yer- tically below and opposite desired cruising altitude (ALT.) read	optimum R. P. M., I. A. S. and MIXTURE setting required.			UN MICES	NAUTICAL	AVAILABLE I	770	380	310	250	180	120	09	NG DATA	MIX. M.P. G. T. M. P. G. T. M.			AR 181 90 365		38 79	38 73	99 0	AK 38 03 1255	<b>Z</b>
ERATION II	•	UMITS: 10,000	INSTRUCTIONS FOR USING CHART: column equal to or less than amount of fuel	to left or right and	e statute or mautical opposite desired or	I. A. S. and MIXT			RANGE IN AIR MILES	STATUTE		210	084	360	290	210	Ott	0,	OPERATING DATA	R.P. M. L.A.S. 101			2450 245	255	2400 255	2400 255	2400 255	GGZ   004Z	EXAMPLE AT 9800 LB. GROSS WT. WITH (AFTER DEDUCTING TOTAL ALLOWATOF P. F. P. F
FLIGHT OP		CHART WEIGHT LIMITS:	INSTRUCTIONS column equal to or	Move horizontally	or greater than to tically below and	optimum R. P. M.			AIR MILES	NAUTICAL	GAL. ALLOWANCE NOT	380	320	270	210	160	110	50	4C DATA	M.F. G. T. TURE N. P. A.		•			F1 97	#2	42 83	AK 43 78 270	
_			IE TOTAL	<u> </u>	178	<u>                                     </u>	-	п	RANGE IN AIR MILES	STATUTE	0 2 tg	0111	370	310	250	080	120	0	OPERATING DATA	R. P. M. 1. A. S. M.					265	265	270	2/0	NOTES WARENT AND STREET AND STREET ST
			URE TIME	10	2	CONT.	-	FUEL	U.S.	GAL.	₹8	0 2	120	8	80	<u> </u>	O t	20	H	ALT. Feet E.P	40000	30000	25000	20000	$\overline{}$	_	5000 2500	2550	F. TAKE OF
E (S)		50-7	LOWER MIXTURE DESTION POSITION	LOS AR	NOW AR	101	-	F		CAL	_									9 K H	2 8	×	115 385 25		355	330	305	98 285	
MODEL(S) P-51D		V-1650-	M. P. BLOWER (DY. RG.) POSITION	4	=	3			RANGE IN AIR MILES	NAUTICAL	360	320	270	230	180	130	06	40	MAXIMUM CONTINUOUS	F 4 5			16	FT	9	9#	9	94	ALLOW 24 CAL FOR PLUS ALLOWANCE FOR HIGH BLOWER A
		:(8):	R. P. K.	3000	3000	2700		-	NGE IN A	F			_	_	_	_	_	_	TIMUM CO	A.S. MIX.	_		260 AR	270 AR			280 AR	280 AR	PLUS PLUS H 16
		ENGINE(S):	LIMITS	WAR	MILITARY	HORMAL			Ä	STATUTE	120	370	310	260	210	150	8	90	MAX	R.P. M. L.A.R.	-		27.00	_		2700		2700	

Figure 48—Flight Operation Instruction Chart—V-1650-7 Engine (Two 500-lb. Wing Bombs—10,000 to 8500 lbs.)

TOTAL G. P. H.
180
176 tically below and opposite desired cruising sittinde (ALT.) read
106 optimum K. P. M., I. A. S. and MLXIUKE setting required.
ш
MANGE IN AIR MILES
GA.
0121
1120
1020
830 800
830 720
O#.2
OPERATING DATA
I. A. S. MIC. M.P.H. TURE
260 AR
250 AR
265 AR
O ALLOW 28 GAL FOR WARHLY! TAKE-OFF & INITIAL CLIMB FULS ALLOWANCE FOR WIND, RESERVE & COMBAT AS RECTO. 2. IF BE-SALLOW PUESLARE THE IS INSTALLED AND SERVICED, WARHLY TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TAK UNTLATED GO ALLOWS ARE USED BEFORE SHITCHING TO COMBAT TAKES. HIGH BLOMER ABOVE HEAVY LINE ONLY.

Figure 49—Flight Operation Instruction Chart—V-1650-7 Engine (Combat Tanks—10,700 to 9600 lbs.)

EMS TANKS	Column 1 - for emergence birth great critising only	NOTES: Column 1 is for time general man special controls of the Columns II, III, IV and V give progressive increase in range at a	agerince in speed. Manicold pressure (2. f. ), ganous per mount (G. P. H.) and true airspeed (T. A. S.) are approximate values	for reference. For efficiency maintain indicated airapeed			>	RANGE IN AIR MILES	NAUTICAL	1020	088	770	640	510	380	280	MAXIMIM RANGE		17.00 17.00 10.00		616 63	FT 53	AL FT 49 265	AL FT 46 250	AL FT 44 235	# #	AL 34 38 205	F.T. PULL TREOTILE F.E. PULL BEST A.E. AUTO-AKEN C.L. CRUSHIC LEAN C.L. CRUSHIC LEAN FLIGHT CRECK
EXTERNAL LOAD ITEMS 75-GALLON COMBAT TANKS	and think an	rogressive incr	Sasture (22. F.)	cy maintain	than 8 in. Hg			RANGE	STATUTE	081	1030	880	240	. 089	1150	300	150		R.P.M. LAS	<u>-</u>	000	+	2050 195	1850 200	1650 200		1600 205	LAS, PORKATO ARRESTO  E. P. MANTOCA PRESSUR  E. P. MANTOCA PRESSUR  C. P. M. CAL PER BOOR  A. M. TORK ARRESTO  F. L. ROLL BOOR  A. M. MONTOCA  E. L. COURSES ARR PRESIDENARY  READ POLITIES ARR PRESIDENARY  SUBJECT TO REFISION AFTER FLIGHT CREAK
EXTER 75-6A		V grive p	peed (1	ficien	Te mor	ŀ	FUEL	u.s.	GAI.	289	240	8	8	120	8	8	8		ALT. Feet	00007	20000		2000	15000	10000	2000	8.1.	DICATED UNITOLD A CALL PRINCIPLE A LEVEL PRINCIPLE A LEVEL PRINCIPLE A LEVEL PRINCIPLE
i cu	- 1	ns II, III, IV and	e in speed. Man H.) and true airs	erence. For ef	(1, A. S.) nourly. Adjust he segment in ceeding manifold pressure more than 3 in. Hg.				NAUTICAL	000	280	670	560	450	340.	220	110		(1) (1) (2) (3) (4) (4) (4)		- 5	37 70 335	FT 65 310	295	36 57 275	36 53 255	36 49 235	A A A PRODUCTO DESIGNATION OF A PRESENTE OF THE A LAWRENCE OF THE LAWRENCE OF THE A
IRT	POUNDS	Columns	G. P.	lor re	ceedin.	١	≥	RANGE IN AIR MILES	_	LH.								OPERATING DATA	S. HELDS.	<u> </u>		2 ×	╌		S AL		ک ا	ને જ ઇવ
<b>S</b>	ğ	r OEL	ual to Ver-	read				EAN	STATUTE	FLIGHT	010	780	920	620	380	260	230	5	R. P. M. L. A. S. M.P. E.			00 225	-	_	2150 235	2150 235	2150 235	240 CAL OF FUEL CES OF 29 CAL.) 20,000 FT. ALT. MPH IND. AMSPEED
OPERATION INSTRUCTION CHART	8000	Select figure in FUEL to be used for cruising.	E value ex he flown.	le (ALT.	required.		$\dashv$		۰	LE IN							1		भ <b>न व</b>			89 355 2400	340	3 5	290	270	250	AT \$500 IN, GROSH WITH 240 GAIL OF FULL (AFTER DEDUCTING THAT ALLOWANGES OF 20 GAL.) FOR PAY ABOUTES AT 20, 500 FT. ALL. MAINTAIN 2350 PPM AND 225 MPH IND. AIRBEED WITH MIXTURE SET. MUTO LEM.
TRUC	2	Select 1	t RANG	ng adtitue	setting			KILES	NAUTICAL	AVAILABLE 750	650	560	180	370	280	180	8	ATA	전 4 4 5 전 3 1	-		5 8	1		38 73		38 63	EXAMPLE  TATE DEDUCTING TOTAL ALLOWAND TO PLY 80 STAT. AMBRILES AT MAINTAIN 2550 PPM AND 225 WITH MIXTURE SET 400 LEM.
N.	္ဓ	HART: nt of fu	and selection	d cruish	XTUR		Ħ	RANGE IN AIR MILES	L			-					-	OPERATING DATA	MDC. TURE			¥ 8	A.R.	¥	¥	¥	¥.	LB. GROSTING TOTAL
TION	0000 3:	JSING C	or right	te desire	S. and M.			RANGE	BTATUTE	BON O	750	940	0πg	0E#	320	210	8	OPER	L LAS		_	240	╂┈		⊢		250	AT \$500 (AFTER DEDUCTO FLY \$50 MAINTAIN 2) WITH MIXTUR
ERA	LIMIT	FOR I	r to left	оррові	. I. A.				E	ANC.									76 76			2450	2550				2400	AT (AF TO 1 MAN
	CHART WEIGHT LIMITS:	INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising.	Move horizontally to left or right and select RANGE value equal to	tically below and opposite desired cruising altitude (ALT.) read	optimum R. P. M., I. A. S. and MLXTURE setting required.			80	TCAL	GAL. ALLOWANCE NOT	. 0	9	0	0	0	0	80		Q 11.75 11.4 4	$\vdash$		+	lacksquare	330	89 305		77 265	ANNUP.
FLIGHT	ART V	NSTRI olumn	fove bo	ically b	ptimun			RMILE	NAUTICAL	L. AI	560	087	400	320	240	160	•	DATA	N A N			$\bot$		F	22		<b>9</b>	10ED, W
표	B	_			$\vdash$		п	RANGE IN AIR MILES	-			-		-		·	-	OPERATING DATA	20 E	-		-	-	A. O.	₽.		- A A	CLIMB INEG'D. ANK UNTT ONBAT T
		TOTAL G. P. H.	66	178				RANG	BTATUTE	-0π -0π -0π -0π -0π -0π -0π -0π -0π -0π	929	98	094	370	280	98	8	0	E. A.S. K.P.E.	ļ		+	-	0 260	╁		0 265	A SHITTAL SMEAT AL TALLED A SELAGE T HG TO C
		TIME	•	2	C0817		L		2	_		_		_					2i 6: 6i	_				2550	₩			AKE-OFT BES HEST ON FUS SHITCH
•		MIXTURE	¥¥	*	¥		FUEL	17.8	GAL	200	2 C	8	20	20	8	8	8		Peet 7	40000		20000		_	19990		8 5	NOTES  NOTES  NAME OF TAKE OF A HITTAL CLIMB  ARE TAKE IS HISTALLED AND SERVICED, MANN-UN  ARE TAKE IS HISTALLED AND SERVICED, MANN-UN  ARE CRILIS ON BUSICARE TAKE UNITLE AT LEAST  ABOVE HEAVY LIME ONLY.
MODEL(S) P-51D	20-7		3	3	컐				TCAL	9	. 9	007	و	و	9	9	8	80	Q 11 14 14 4	+		20 20	35.00	13345	108 320	103 300	98 28	NOTES  MALOW 29 CAL FOR WARRANT PARE OT A FORTH CALIE TO THE STATE OF A FORTH CALLED TO THE OTHER TO COMBAT TAKES.  HIGH BLOWER AS ABOVE HEAVY LINE OHLY.
F .	V-1650-7	M. P. BLOWER (IN. MG.) PORITION	29	=				RANGE IN ATR MILES	* AUTICAL	520	470	9	330	270	200	130	•	CONTINUOUS	N 4 N			- 1	נו פ		Т			© ALLOW 20 CAL FOR W PLUS ALLOWANCE FOR N PLUS ALLOW FUSEL. TAKE-0F, CLIMF, M SO SALLONS ARE USEL BLOWER.
		R. P. M.	9008	9008	2700		-	TE DI AL	-	+-		-		-		<del>                                     </del>		10) K	2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	+		-	¥ 3		╁		*	O S S S S S S S S S S S S S S S S S S S
	ENGINE(S):	LIDETTS R.	*	2				EANG	STATOTE	•	0712	997	380	3.0	230	26	2	MAXIMUM	R.P. M. L.A.S.	+	_	_	27.00				2700 275	

Figure 50—Flight Operation Instruction Chart—V-1650-7 Engine (Combat Tanks—9600 to 8000 lbs.)

Figures 56-64, pages 61-75, deleted in revision, dated 7 May 1947

AN 01-60JE-1

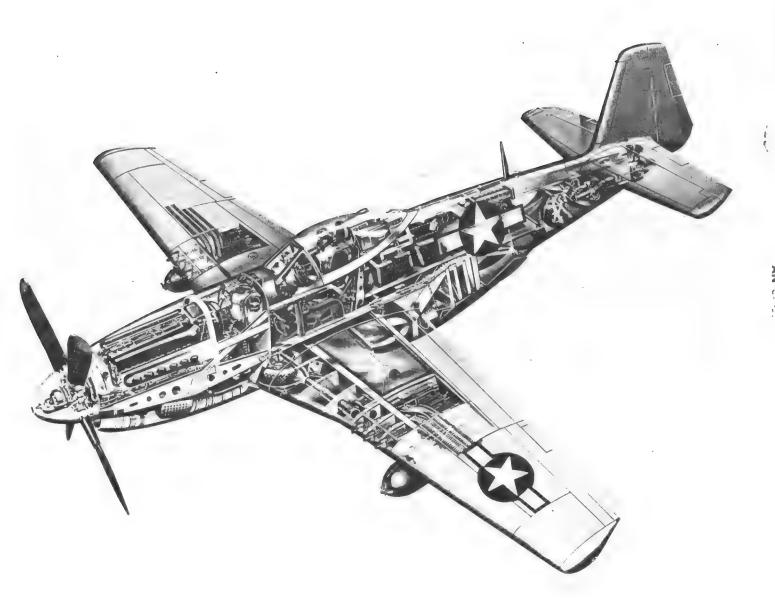
For use with V-1650-3 engine only regardless of airplane model.

	A IRCRA	A IRCRAFT MODEL (S)	L (S)												'				ENGIN	ENGINE MODEL(S)	(8)	
FNC-5	P-51D	P-51D AND P-51K	¥				Y	TAKE-OFF,			3	4 LANDING CHART	9	AR					V- 16	V- 1650-3		
								TAK	E-0	FF D	IST/	ANCI	E PEET									
GROSS	HEAD		=	HARD SE	SURFACE	RUNWAY					80	SOD-TURE	RUNWAY	~				SOFT	SURFAC	SURFACE RUNWAY	١,	
WEIGHT	N N		اسا	Ц	AT 3000 FEET	FEET	AT 6000	DO FEET	¥.	SEA LEYEL		AT 3000	) FEET	AT 6	AT 6000 FEET	A.	SEA LEVE	Н	AT 3000 FEET	FEET	AT 600	6000 FEET
re.	H.P. H. KTS.	-	5.02		•	TO CLEAR. 50' 08J.	GROUND	TO CLEAR 50'0BJ.	AR GROUND J. RUN		TO CLEAR 50' OBJ.	RUR	TO CLEAR NO. OBJ.	ROUND	TO CLEAR 50'08J.	AR BROUND J. RUH		TO CLEAR 61 50'08J.	RUM	TO CLEAR 50°08J.	RUM	TO CLEAR 50'0BJ.
0006	0 0 17 34 30 51 45	1350	2000 1550 1550 850 850		1500 1150 150 150	2200 1700 1300 950	0026 0026 0030 0030	2450 1950 1500	250 250 250 250 250 250 250 250 250 250		2500 1200 8500 8500	3838 3838	22 22 25 25 25 25 25 25 25	3235 525 525 5	2250 1550 1550 1550	1600 1200 850 550		2250 1750 1300 900	6000 6000 6000	2450 1500 1400 1400 1400	75000 15000 75000	2750 2200 1650 1200
	0 0 17 15 34 30 51 45	88.88 88.89 88.89 88.89 88.89	2700 2150 1500	75000		2300 2300 2300 250 250	22 23 23 23 25 25 25 25 25 25 25 25 25 25 25 25 25	2050 2050 2050 1500	1950 1450 1050 700		2500 2500 2500 2500 2500 2500	23528 88588	2000 2000 2000 2000 2000 2000 2000 200	5252	2700 2700 2100 1550	1250 1700 1201 800	2450		2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2700 2700 2650 5650	7 1 2 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	3800 3100 2300 1750
13,000 20 2500 3600 2500 2550 2550 2550 2550 2550 2550 2	22870	1200 1700 1200 850	2860 2860 1550 1550			3800 2300 1750	2800 22800 22800 22800 22800	4300 3400 2700 2100	24 28 28 28 28 28 28 28 28 28 28 28 28 28		<u> </u>	2882 2882 2882	25000 25000 25000 25000 25000	827 835 835 835 835 835 835 835 835 835 835			·			4800 8700 2850 2000		5200 8200 3200 2700
	HART DISTA	NCES AS FOLL BASED ON:	PLIGHT	108; 100°F	.r + 208; 125	+	305; 150°F	F1 405						NUM I HUM	H TAKE-OFF	WITH 3000	Ē	1	ä	FLAP 15 80\$	OF CHART	VALUES
									CLIM	<b> </b> _	DATA	_										
	AT S	AT SEA LEVEL	$\vdash$	ΑŢ	5000 FEET	EE	H	AT 10	10,000 FEET	5		AT 15,000	DOO FEET	_	IV	20,000	O FEET	-	AT :	25,000 . FEET	FEET	
	BEST 1.A. S.	RATE	BEST BEST	T 1.4.8.	ш	131	VEL BEST	1. A. S.		FROM SEA LEVEL	16.8T	1. A. S. RA	ш	FROM SEA LEVEL	BEST 1. A. S.	Ľ	FROM SEA LEVEL	LEVEL BEST	4-1		FROM SEA LEVEL	
WEIGHI LB.	ETS.	OF CLIMB F. P. R.	FUEL METH USED	ST.	OF CL198 F. P. R.	TINE FU	FUEL MEN	E	CLIMB T	TIME FUEL	10	*공간  립	CLING HIS.	FUEL I. USED	ET.	12 12 12 12 12 12 12 12 12 12 12 12 12 1	## ## ## ## ## ## ## ## ## ## ## ## ##	13 G3 S1	E	C. S. T.	TIME FUEL MIN. USED	
			<u> </u>			·					170						5.0		3			
000	9/1 9/1 9/1 9/1	ž §	81 87 87	9 9	8 2	 	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	₹ 35	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	7.0	175	5 8 5 8	850 850 17.0	ki 0	170 145	2	5 2 0 0	<b>25</b> 28	9 160 165 165 165	9 00 8 00 8 00	19.0 t7	
POWER PLANT SETTINGS: (DETAILS ON FIG. DATA AS OF 5-8-45	5: (DETAILS 65	DH FIG. SECTION I	SECTION !	OHT TESTS	TS		$\mid \mid$	1								FUEL USED	(u. s. a	AL.) 190	LUDES WAR	H-UP & TA	(U.S. BAL.) INCLUDES WARM-UP A TAKE-OFF ALLOWANCE	OWANCE
								LAN	Z	9	STA	NCE	=									
GROSS	BEST	BEST IAS APPROACH	ACH		HA	HARD DRY SURFACE	SURF	ICE				Ē	FIRM DRY SOD	200				5	WET OR S	SLIPPERY	  -	
WEIGHT	POWER	PONE	<	T SEA	SEA LEVEL	AT 300	AT 3000 FEET	-	AT 6000 FEET	Н	AT SEA LEVEL	Н	AT 3000 FEET	FEET	AT 6000 FEET	FEET	AT SEA LEVEL	LEVEL	AT 300	AT 3000 FEET	AT 6000 FEET	O FEET
rg.	MPH KTS	Ĭ	KTS	ROLL	TO CLEAK 50'08J.	GROUND ROLL	TO CLEAR 50' OBJ.		BOLL 50'05J.	EAR GROUND EJ. ROLL		TO CLEAR GA	GROUND TO ROLL 5	TO CLEAR SO' DEJ.	GROUND T	TO CLEAR 50'08J.	GROUND ROLL	TO CLEAR SO' OSJ.	TIQU GHOONS	TO CLEAR SO' OBJ.	GROUNE	TO CLEAR 50' OBJ.
8000	3 8	115 130	115	1200 230	2300	1200	2400	1500	2600	90.00		2400	0091	2600	1700 1500	2800	3200	# 100 1800	3 100	0094		\$000 4500
REMARKS:		7																	A NOW LA	LEGEND	# 1	VALUES
NOTE: TO DETERMINE FUEL CONSUMPTION IN BRITISH IMPERIAL GALLONS,	ERIAL GA	L CONSUMP	101				MIXTURE:		USE "RI		AUTO	"RUM" OR "AUTO RICH -AUTO LEAM"	-AUTO	LEAN"					- # # - # # 8	wi ±	: INDICATED AIRSPEED : MILES PER HOUR : KWOTS	9334
MULTIPLY BY 10	THEM D	IVIDE BY	2																٠	F.P.H. : FEE	FEET PER MINUTE	

For use with V-1650-3 engine only regardless of airplane model.

For use with V-1650-3 engine only regardless of airplane model.

Figure 64—Take-off, Climb and Landing Chart



DATA

Chart-

V-1650-7

RESTRICTED

Figure

### SPEC. AN-H-8 DEC. 18, 1942 **AIRPLANE MODELS ENGINE MODELS** SPECIFIC ENGINE PACKARD V-1650-7 P-51D **FLIGHT CHART** COOLANT FUEL OIL OIL MAX. PERMISSIBLE DIVING RPM:....3240..... CONDITION PRESSURE PRESSURE TEMP. TEMP. ALLOWABLE OIL CONSUMPTION CONDITION (LB/SQ. IN.) (LB/SQ. IN.) °C °F °C °F 100-212-MAX. CONT. DESIRED 12-16 70-80 70-80 110 230 176 MAX. CRUISE MAXIMUM 19 90 90 194 121 250 MIN. SPECIFIC ...3....U.S.QT/HR.....IMP.PT/HR MINIMUM 59 60 140 15 12 50 IDLING 9 15 SPEC. AM-F-28 OCTANE 100 FUEL GRADE: TWO SPEED. TWO STAGE SUPERCHARGER TYPE: GRADE 130 FUEL FLOW MAXIMUM MAXIMUM CRITICAL ALTITUDE MIXTURE MANIFOLD **USE LOW OPERATING** HORSE-(GAL/HR/ENG.) CYL. TEMP. DURATION BLOWER CONTROL **RPM** PRESSURE CONDITION **POWER** POSITION (MINUTES) WITH RAM NO RAM (BOOST) BELOW: U.S. •c TAKE-OFF A.R. 5 3000 61 1490 S.L. LOW 161 194 1720 6,200 LOW A.R. WAR 5 3000 67 187 1505 19.300 HIGH A.R. **EMERGENCY** 178 1590 8.500 LOW A.R. 15 MILITARY 3000 61 170 1370 21,400 HIGH A.R. 109 MUMIXAM 1180 11.300 A.R. 2700 46 LOW CONT. 106 CONTINUOUS 23,400 HIGH 1065 A.R. 66 MAXIMUM 820 14.000 LOW A.L. CONT. 36 2400 64 CRUISE 760 23,700 A.L. HIGH MINIMUM SPECIFIC CONSUMPTION ADDITIONAL INFORMATION WILL BE INCORPORATED IN THIS CHART WHEN AVAILABLE.

ř

Figure
29—Specific
Engine Flight
Chart-V-1650-3

RESTRICTED

SPEC. AN-H-8 DEC. 18, 1942 FORM ASC-512		NE MODELS						ENGIN CHART	E				AODEI .1650-3	
	FUEL	OIL	O	IL		LANT			MAX. PERM	ISSIBLE	DIVING R	PM:	3240	
CONDITION	PRESSURE		·c	*F	°C	Ψr.			CONDITIO	ON	ALI	LOWABLE	OIL CON	SUMPTION
DESIRED	12-16	70-80	70-80	158- 176	100-	212- 230			MAX. CC	NT.		J.S.QT/I	HR	IMP.PT/F
MAXIMUM	19	90	90	194	121	250			MAX. CR	UISE	بد ا	J.S.QT/I	HR	IMP.PT/I
MINIMUM	12	50	15	59	60	140			MIN. SPE	CIFIC	3	J.S.QT/	HR	IMP.PT/F
IDLING	9	15	_		<u> </u>		-		OIL GRADE:	(S)	JJ00	۰	<b>M)</b> iJi	90
SUPERCHARG	ER TYPE:	TWO SPEED, TO	NO STAGE	1	<u> </u>	L			FUEL G	RADE:	SPEC. AN-			OCTANE
OPERATING		MANIFOLD	HORSE-	T (	RITICAL	ALTITU	DE S	USE LOW BLOWER	MIXTURE		FLOW HR/ENG.)		MUM TEMP.	MAXIMUM
CONDITION	RPM	PRESSURE (BOOST)	POWER	wn	H RAM	NO I	DE NAM	BELOW:	POSITION	U.S.		.c	*F	(MINUTES)
TAKE-OFF	3000	61	1400		i.L.	s.	L. LOW		AR	150				5
WAR	3000	67	1595	1	7,000	11,	1 1		AR	166				5
EMERGENCY	1		1295		8,800	23,			AR	160	<del> </del>		<del>                                     </del>	<del> </del>
MILITARY	3000	61	1450 1190	1	9,800 1.200	13,	. 1		AR - AR	158 				15
MAXIMUM CONTINUOUS	2700	46	1120 940	20	0,500 4,400	17,	500 LOW 500 HIGH		AR AR	111				CONT.
MAXIMUM CRUISE	2400	36 36	800 700		,500 2,300	1	500 LOW		AL AL	74 70				CONT.
MINIMUM	1600 1600 1600	27 30 31 F.T. F.T.	370 440 480 510 560		S.L. 5,000 0,000 5,000		LOW LOW LOW LOW		AL AL AL AL	35 39 42 45 50				CONT.

								1 000		,,,,,	1100	1 000	1200	34	<b>,,</b>
)	2300 1800 1300 900	2 2	300 500 100 500	2000 1500 1100 700	2800 2200 1700 1200	2100 1600 1200 800	3100 2400 1900 1400	2400 1900 1400 1000	3400 2700 2100 1600	2300 1700 1200 800	3200 2500 1900 1300	2500 1900 1400 1000	3400 2700 2100 1500	220	00
_ ;	% FC	OR EA	CH 30	F ABOVE 3	2°F)			ENGI	NE LIMI	TS FOR TAK	E-OFF	3000	RPM &	61	
	FT. ALT.		<del></del>	CLIM	B D	ATA FT. ALT.				RY MISSION	IS USE	2400			36
4					TIME		-	20,			+	25,000		FT. ALT.	
-	PUBL PROF	M S.L.	9857 (	A.S. PT/MW	PROM	PUBL PROM S.I	. 0657	I.A.1. 77/MB	MORT 1	FUEL PROM 5.1	. BEST 1	A.S. 77/80	TIME H FROM	PUBL PROJ	W S.L.
_	U. S.		MPH		1. L	U. S.	MPH		S. L.	U.S.	MPH		S. L.	U.S.	
. 5 . 6			165 165	1270 730	9.5 20.5		160 165	1150	1		155	950 200	1		
. 2 . 5			165 165	. 1650 1050	7.8	1 - 1	160	1560 750	1	1 ** [	155	1350			
.2 .5			165 165	2000	6.4	28 28	160	1950		,	155	1750	1	38	

AT 6,000 FT.

GROUNG

TO CLEAR

AT 4.000 FT.

TO CLEAS

GEOUNG

TAKE-OFF, CLIMB & LANDING CHART

TAKE-OFF DISTANCE (IN PEET)

LANDING DISTANCE (INFEET)

BOUNE

AT SEA LEVEL

TO CLEAR 30' DBJ.

FIRM DRY SOD

BOLL

AT 3.000 FT.

TO CLEAR

50' 001

AT SEA! LEVEL

SOD-TURF RUNWAY

AT 3.000 FT.

TO CLEAR

SECUND SUN

ENGINE MODELS

V-1650-7

FUEL INCLUDES WARM-UP AND TAKE-OFF ALLOWANCE

WET OR SLIPPERY

GEOUNG

AT 3,000 FT.

F.A.S.: Indicated Air Speed M.P.M.: Miles For Hour S.L.: See Lavel U.S.: U. S. Gallens

MP.: Imperial Gallone
MOTE: All Distances are Average
RED FIGURES HAYE NOT BEEN FLIGHT CHECKED

TO CLEAR

50' ON.

AT SEA LEVEL

TO CULAR

**GROUND** 

AT SEA LEVEL

TO CLEAR

50' 084

SOFT SURFACE BUNWAY

AT 3,000 FT.

TO CLEAR SO' OOL

AT 4,000 FT.

10 CIEA

PL 100

AUTO

AUTO

AUTO

AUTO

AUTO

AUTO.

AT 4,000 FT.

TO CLEAR

IN. HG

Figure 43—Take-off, Climb, and Landing Charl

AIRPLANE MODELS

AT SEA LEVEL

RPM &

TIME PROM

1600 3.3 165

730 0.8 185

2.6 165

4.8 165

2.1 165

3.0 165

5 % FOR EACH 10°C ABOVE 0°C (

SEST LA.S.

\$ L TO 5000 FLAIT.

AT SEA LEVEL

BOUNG

TO CLEAR

50' COL

9000 POUNDS IS MITH NO EXTERNAL LOAD 10,000 AND 11,000 POUNDS ARE MITH BOMBS

HARD SURFACE RUNWAY

AT 3,000 FT.

TO CLEAR SE' OSJ.

BUN

SIL HO

FT/MIN

1630 6.

1090 9.

2410 4.

**Should** 

BOLL

HARD DRY SURFACE

AT 3,000 FT.

TO CLEAR

50' ON.

1400 7.

NOTE: INCREASED ELAPSED CLIMBING TIME 5 % FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE ( 5 % FOR EACH 20°F ABOVE 32°F)

AT 4,000 FT.

POLL

TO CLEAR 30' OBJ.

NOTE: FOR GROUND TEMPERATURES ABOVE 35°C 195°F) INCREASE APPROACH I.A.S. 10% AND ALLOW 20% INCREASE IN GROUND ROLL.

780 13.

10,000

AT 4,000 FT.

TO CLEAR SO' COL.

P - 51D

HEAD WIND

APRI

NOTE: INCREASE DISTANCE

COMBAT MISSIONS USE

TYPE

CLUMB

MPH.

BEST I. A. S

APPROACH

OR EXTERNAL TANKS.

MPH

GROSS

WHONT

ONLUNE.

10.000

11,000

11.000

10.000

GROSS

WEIGHT

IN LAS.

REMARKS

RESTRICTED

	Figure
(Wir	Figure 44—Flight O
ia Bomb Ra	Operation I
cks-9600 to	nstruction
(Wina Bomb Racks—9600 to 8000 lbs.)	ChartV-1650-7
	Engine

8000 lbs.)

MODEL(S) P-5ID	FLIGHT	<b>OPERATION</b>	INSTRUCTION	CHART
P-51D	rLiuni	UPERATION	INSTRUCTION	Ullmit

EXTERNAL LOAD ITEMS WING BOMB RACKS

ENGIN	E(S):	V-165	50-7				
LIMITS	R. P. M.	M. P. (IN, EG.)	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G. P. H.	
WAR MAX.	3000	67	LOW HIGH	AR	5	194	
MILITARY POWER	3000	61	LOW	AR	15	178	
MORMAL	2700	4.6	LOW	AR	CONT.	109	١

9600 8000 POUNDS CHART WEIGHT LIMITS: TO INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

		I				- 1:	FUEL			II						Ш			- 1			IV				FUEL			Y			
	RANGE	IN AII	R MII	ES	_	—I '	U.S.		RANGE	IN AIR	HILE	8			RANGE	N AIR	MILE	8			RANGE I	N AIR	MILE	8		U.S.		RANGE				
STAT	UIE	1	NA.	JTIC.	AL		GAL.	BTA!	TUTE		NAUT				TUTE		NAU:			BTA	TUTE	1	TUAN	ICAI	-	GAL.	BTA'	TUTE		NAU	PICA:	i .
68	0			590			269		1 29 20	GAI	71		ow.	ANCE 9	NOT 50	AV	AIL 8	A B 1	LE		LIGH 20	<b>T</b>	97	0		269 240	12	70		11		
59	0			510			210	7	20		62	0		8	30	ļ.	7	20		9	80		85	0	_	210	11	10	<u> </u>		60	
51	0			440			180	6	10		53	0		7	10		. 6	10		8	140		. 73	0		180		50			30	
42	0			370			150	5	10		44	0		5	90		5	10		. 7	00		61	0		150	7	90			80	
34	0	$\top$		290			120	4	10		35	0		ч	70		4	10		5	60		48	0		120	`	140		•	50	
25	0			220			90	. 3	00		26	0	-41	3	50	_   _		10			120		36	0		90	۱ ۱	180		- 4	20	
17	^	+-		140	_	_	60		200	1.	17		-	2	30	1		00	-	a	280		Ž4	0		50	3	20	T	2	80	
8	-			70			30		00			0		Ī	10		1	00		١	140		12	20		30	١	60		1	40	
M	AXIMUI	M CON	TINU	OUS		$\dashv$			OPERA	TING D	ATA				OPER.	ATING	DATA	-	_		OPER	ATING I	ATA					MAXI	MUM R.	ANGE		_
R. P. M.	l. A. B. M.P.R.	MIX- TURE			.	T.	ALT. Feet	R. P. M.	L A. S. M.P.H.	MIX- TURE	M. P. lu. Bg.	g. P. M.	T. A.	R. P. M.	L A. S. M.P.H.	MIX. TURE	M. P. In. Hg.	G. P. M.	T. A. B.	R. P. M.	L.A.B. M.P.E.	MEX. TURE	M. P. ln. Hg.	G. P. M.	T.	ALT. Feet	R. P. M.	L.A.S. M.P.E.	MIX- TURE	M. P. In. Es.	G. P. E.	T. A. B.
2700 27 <b>0</b> 0	230 265	AR AR	FI	8	٥	<b>40</b> 0	40000 35000 30000							2600	255	AR	FT	90	410	2500	245	AR	FT	75	390	40000 85000 80000	2550 2350	205 205	AB AĽ	FT	62 58	36
2700	280	AR	46		-	$\dashv$	25000						_	2400	260	AR	FT	87	380	2400	245	AL	36	70	360	25000	2100	205	AL	FT	52	30
2700 2700	290	AR	F.	10	0		20000 15000	2550	290	AR	FΤ	97	365	2600 2400	270 270	AR AR	F1 39	8 <del>4</del> 78		2350 2150	245 250	AL	FT		335 315		1.000	205 205	AL	FT	44	26
2700	305	AR	40	-	_	355	19000	2500	285	AR	43		335	2400	270	AR	38	73		2150	250	AL	36	57	295	10000	1650	210	AL	FT	42	25
2700	305	AR	40		. 1	330	5000	2500	285	AR	43		310	2400	270	AR	38	66	290	2150	250	-AL	36	54	275	5000	1600	210	AL	33	39	23
2700	305	AR	44	;   g	8	310	S. L.	2550	285	AR	43	77	290	2400	270	AR	38	63	270	2150	250	AL	36	48	250	S.L.	1600	200	AL	31	34	20

NOTES

# EXAMPLE

AT 9400 IB GROSS WT. WITH 240 GAL OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 1000 STAT AIRMILES AT 20,000 FT. ALT MAINTAIN 2350 RPM AND 245 MPH IND AIRSPEED WITH MIXTURE SET AUTO LEAR

### LECEND

L.A.S.: INDICATED AIRSPEED M.P.: MANIFOLD PRESSURE G.P.M.: U.S. GALL PER NOUR T.A.S.: TRUE AIRSPEED S.L.: SEA LEVEL

T ALLOW 28 GAL FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D

<sup>2,</sup> IF 85 GALLON FUSELAGE TANK IS INSTALLED AND SERVICES. WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO WING TANKS.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

F.T.: FULL THROTTLE F.R.: FULL RICH A.R.: AUTO-RICH A.L.: AUTO-LEAN C.L.: CRUISING LEAN

Figure 45-Flight Operation Instruction Chart-V-1650-7, Engine (Two 300-lb. Wing Bombs-10,000 to 9500 lbs.)

RESTRICTED

FLIGHT OPERATING CHARTS Appendix

MODEL(S) P-51D

# FLIGHT OPERATION INSTRUCTION CHART

### EXTERNAL LOAD ITEMS

2 - 300-LB. WING BOMBS (OR SMALLER SIZE)

ENGINE(S): V-1650-7

CHART WEIGHT LIMITS:

10,000

POUNDS TO

M. P. (Df. HG.) BLOWER MIXTURE POSITION POSITION TIME TOTAL G. P. H. LIMITS 3. P. M. 194 2000 67 5 WAR 1110 187 LOW 78 MILITARY 2000 61 AR 15 LOW 109 NORMAL BATED 2700 46 AR CONT.

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read ontimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II. III. IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

	l FUEL II												Ш			Ī			IV-				FUEL			٧						
	RANGE	IN A	IR MIL	ES			U.S.		RANGE	IN AIR	MILE	8			RANGE	IN AIR	MILE	5			RANGE I	N AIB	MILE	8		U. S.		RANGE	IN AIR	MILE	:\$	
5TAT	UIB	$\neg$	NA	UTIC	AL		GAL.	STA	TUTE	ī	NAU	TCAL		STA	TUTE		NAU	TCAL	. ]	STA	TUTE		NAUT	MCAI	-	GAL.	STA	TUTE	$\perp$	NAU	TICA	ւ
	50			580			269		[ 29 790	GA:		LLL 80	ow.	ANCE	TON	AV		A B :	LE		LIGH 070	T	D 93	ra		269	1	240		. 16	080	
							240			$\perp$						-						$\perp$		_	4	240			+			
51	90		5	10			220		720	0 570				8	40		7	30			990		85	0		220	1	140		9	80	
5	540 470 200 850 180 - 420 180 590				5	70		. 7	760		6	60			890		770	,	İ	200	ι	030		s	000							
14	80					5	10		6	80		5	90			800		890			180	<u> </u>	930	$\bot$		10						
4	30	1		170			150		520		4	50			10		5	30			710		620	,		160		830		,	20	
3	80	1	3	30			140		460		4	00			530		4	80			620		540			140		730			30	
м	AXIMU	M CO	NTINU	OU	,				OPER	ATING	DATA				OPER	ATING	DATA				OPER.	ATING :	ATA					MAXI	MUM R.	LNGE		,
R. P. M.	I. A. S. M.P.H.	MIX		.   1	0. P.	T. A. B.	ALT. Feet	R. P. M	L.A.S. M.P.H	MIX- TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	L.A.S. M.P.H.	MIX- TURE	M. P. In. He.	д. Р. Н.	T. A. B.	R. P. M.	L A. S. H.P.E.	MEK- TURE	M. P. In. Her,	G. P. E.	T. A. B.	ALT. Feet	R. P. M.	LAS. M.P.K.	MIK- TURE	M. P. In. Mg.	G. P. EL	7. A. B.
		*					40000 35000 30000																			40000 35000 30000						
2700	270	Al	R 4	6 1	15	395	25000			_				2450	255	AR	41	86	375	2400	235	AR	37	71	350	25000	2100	200	AL	FT	53	295
2700	275	ĀI	R F	ΤI	00	375	20000						Г	2550	260	AR	FΤ	83	1	2400	240	AL	FT	1	330		2050	200	AL	FT	1	275
2700	290	A	R 4	6 1	13	365	15000	2550	280	AR	FT	96	350	2400	260	AR	39	78	330	2200	245	AL	FT	63	310	15000	1800	200	AL	FT	45	255
2700	290	Al	. 1		1	340		2550	280	AR	43		325	2400	260	AR	38	72	305		250	AL	36		290	1	1650	205	AL	FT	1	240
2700	290 290	A	- 1	- 1	- 1	315 295	i	2550 2500	275 275	AR	43	82 75	300 275	2400	260 260	AR AR	38 38	67 63	280	2250	250 250	AL	36 36	1	270 250	i	1600	205	AL	33		210
-	<u> </u>	1	1	1.	!		OTES	L	1	1	1	1				<u> </u>	EXAM	PLE			<u> </u>	1	-	1	1		L	GEND	·	<u>- · · </u>	•	

D ALLOW 29 CAL. FOR WARM-UP, TAKE-OFF A INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT. AS REQ'D.

<sup>2.</sup> IF 85-GALLON FUSELAGE TANK IS INSTALLED, WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO WING TANKS. HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE LB CROSS WT. WITH 240 CAL OF FUEL AT 9800 (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 1000 STAT. AIRMILES AT 10,000 FT. ALT. MAINTAIN 2200 RPM AND 250 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAN.

L.A.S.: INDICATED AIRSPEED M.P.: MANIPOLD PRESSURE L.P.H.: U.S. GAL PER HOUR T. A. S. TRUE AIRSPEED

P. T.: FULL THROTTLE P.R.: FULL RICK A.R.: AUTO-RICH A.L.: AUTO-LEAN C.L.: CRUISING LEAN

Figure

46-Flight Operation (Two 300-lb. Wing

Instruction

Chart-V-1650-7 Engine

Bombs-9500 to 8000 lbs.)

# FLIGHT OPERATING CHARTS

EXTERNAL LOAD ITEMS 2 - 300-LB. WING BOMBS (OR SMALLER SIZE)

FLIGHT OPERATION INSTRUCTION CHART

P-5ID

MODEL(S)

9500 CHART WEIGHT LIMITS:

**POUNDS** 

ENGIN	E(8):	V-16	50-7			
LIMITE	R. P. M.	M. P. (Di. MG.)		MIXTURE	TIME	TOTAL G. P. H.
WAR.	3000	67	EON .	AR	5	194
MILITARY	3000	61	LOM H I GH	AR	15	178
NORMAL RATED	2700	46	LOM H I GH	AR	CONT.	109

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

	I RANGE IN AIR MILES						FUEL			II						ш						IV			_]:	FUEL				•		
	BANGE	IN AI	RM	ILE:		_	U. S.		RANGE	IN AIR	MILE	s			RANGE	IN AIR	MILE	8			RANGE	IN AIR I	MILE	8		U.S.			IN AIR		_	
STA	TUTE		N	AUT	ICAL		GAL.	STA	TUTE		NAU	TICAL	.	STA	TUTE		NAU'	TICA:	L	BTA	TUTE	1	TUAN	ICAL	.	GAL.	BTAT	TUTE		NAU	TICAL	
						$\neg$	1011		1 24	GA	L. 1	LL	OW.	ANCE	NOT	AV	AIL	A B	LE	IN F	LIGH	T	0			184			1			
1	30			370	9	į	184	50	-		43	0	- 1	e	00		52	0	l	7	720		62	0		160	8	50		74	-	
	80	1		330	9		140	111	10		36	0		5	30		46	0			330	<u>. İ</u>	54	0		140	7	40	$\perp$	65	0	
	320	1		28	0		120	36	30		33	10		1	150		35	0		!	540		46	0		120	6	40		55	0	
2	270			23	0		100	3	0		27	0		3	880		33	0		1	450		3.5	0		100	5	30		46	0	
	210			18	0		80	2!	50		22	20		3	300		26	0			360		31	0		80	14	130		37	0	
	160			14	0		60	11	90		10	50			220		18	0			270		23	30		60	3	20	$\perp$	28	70	
	110			9	0		40	12	20		1.	10			150		13	30			180		18	50		40	2	220		18	0	
	50			4	0		20	,	50			50			70		(	50			90		;	70		20	ı	011	1	10	00	
1	AXIMU.	M CO	NTD	NUOI	UB				OPER.	TING	DATA				OPER	ATING	DATA				OPER	ATING I	ATA					MAXI	IMUM R.	ANGE		
R. P. M.	LAS.	MIX		LP. in. Mg.	g. P. E.	T.	ALT. Feet	E. P. M.	LAS.	MIX- TURE	M. P. In. Mg.	G. P.	T. A.	R. P. M.	L A. S. M.P.E.	MIX- TURE	M. P. In. He.	G. P.	T.	R. P. M.	I. A. S. M.P.E.	· MIX- TURE	M. P. la. Mg.	G, P.	T. A. B.	ALT. Feet	R. P. M.	L.A.B. M.P.E.	MIX- TURE	M. P. In. Mg.	G. P. E.	T. A. B.
		-	+	-	-	-	40000			_	-	H	-				1									40000						
							85000 80000																			35000 30000						
	070	A	-	46	115	395				_	$\vdash$	╌		2450	255	AR	41	89	375	2400	240	AR	37	71	355	25000	2100	205	AL	FT	52	305
2700	270	-	-		_	_					$\vdash$	-	-	_		-	FT	84	+	-	240	41	FT	66	330	20000	2050	205	AL	ET	49	28
2700 2700	275	A	<u>"  </u>	- 1		375 365		2550	280	AR	FT	100	350	2550 2400	260 260	AR AR	39		330	1	1	AL	1	1	310	15000	1800		AL	1	45	1
2700	290	A	R	46	108	340	10000	2550	280	AR	43	93	325	2400	260	AR	38	73	305	2250	250	AL	36	58	290	10000	1650	210	AL	FT	42	245
2700	290	A	. 1	46		315		2550	280	AR	43	86	300	2400	260	AR	38	67	280	2250	250	AL	36	54	270	5000	1600	210	AL	33	40	230
2700	290	A	R	46	1	295	1	2550	280	AR	43	80	280	2400	260	AR	38	62	260	2250	250	AL	36	50	250	8. L.	1600	210	AL	32	37	210
<b></b>	!	<u> </u>				<u>'</u>			1 ,		-		•			<u>'                                     </u>	Fran			<u></u>			_				1.3	GEND				

VOTES T ALLOW 24 GAL FOR WIRM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND RESERVE & COMBAT AS REQ'D

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE AT 9300 LB GROSS WT. WITH 160 GAL OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 24 CAL.) TO FLY 550 STAT AIRMILES AT 10,000 FT. ALT MAINTAIN 2250 RPM AND 250 MPH IND AIRSPEED WITH MIXTURE SET AUTO LEAN

L.A. S.: INDICATED AIRSPEED M. P.: MANIFOLD PRESSURE C. P. M.: U. S. GALL PER HOUR T. A. S.: TRUZ AIRSPEED S. L.: SEA LEVEL

F. T.: FULL THROTTLE F. E.: FULL RICH A. E.: AUTO-RICH A. L.: AUTO-LEAN C. L.: CRUISING LEAN

Figure (Two 500-lb. Wing Bombs-10,500 to 10,000 lbs.) 47-Flight Operation Instruction Chart-V-1650-7 Engine

RESTRICTED

MODEL(S) P-51 D

# FLIGHT OPERATION INSTRUCTION CHART

EXTERNAL LOAD ITEMS 2 - 500-LB. WING BOMBS

ENGINE(8): V-1650-7

CHART WEIGHT LIMITS: 10,500

TO 10.000 POUNDS

	-(-,-	, ,,,,				
LIMITE	R.P.M.	M. P. (Df. HG.)		MIXTURE POSITION	TIME	TOTAL G. P. E.
WAR.	2000	67	LON	AR	8	194
MILITARY	2000	61	LON	AR	16	178 170
HORMAL BATED	2700	46	Ha	AR	CONT.	188

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

		1					FUEL			П						Ш						IV				FUEL			V			
	RANGE	IN AI	R KI	LES			U. S.		RANGE	IN AII	MIL	ts			RANGE	IN ALE	MILI	:5			RANGE	IN AIR	MILE	:8		U. S.		RANGI	IN All	s Milli	ES.	
87/	ATUTE		N/	UT	ICAL	•	GAL	STA	TUTE	$\neg$	NAU	TICAL	L	ST.	TUTE		NAU	TICAL	L	ST.	ATUTE		NAU	TICA	L I	GAL.	8T/	TUTE		NAU	TICA	L
	630			540	0	,	269 240		1 2 760	9 GA		ALL 60	ow	l	970	AV		A B 60	LE		LIGH 1020	T	D 8:	90		269 240		180		10	20	
	570			500	,		220		700		8.	10			800		6	90			940		8.	10		220	,	080		94	40	
	520			450	,		200		640		5	50			730		6	30			850		74	0		200		980		8:	50	
	470			410	)		180		570		5(	00			850		5	70			770		58	0		180		880		77	70	
	<b>420</b>			360	,		160		510		4	40			580		5	00			680		59	0		160		790		61	80	,
	370			320			140		<b>##</b> 0	1	3	90			510		4	40			600		52	0		140		690		60	00	
1	MAXIMU	M CON	TIN	UOU	18				OPER/	ATING I	DATA				OPER	ATING	DATA				OPER.	ATUNG I	DATA					MAX	MUN R	ANGE	•	
R. P. M	LAS. M.P.E.	MEX- TURE	M. M	-	G. P. E.	T. A.	ALT. Feet	R. P. M.	L A. S. M.P.W.	MIX- TURE	M. P. In. Mg.	g. 2. 11.	Y. 4 &	R. P. M.	L.A.S. M.P.R.	MEX. TURE	M. P. In. Mg.	G. P.	T. A.	R. P. M.	LAS.	MIX- TURE	M. P. In. Eg.	2. 2.	T. 4. 8.	ALT. Feet	R. P. M.	L A.E.	MDG- TURE	M. P. In. Eg.	G. P.	A
							40000 85000 30000																			40000 35000 30000						
2700	260	AR	ı	6	115	385	25000							2500	245	AR	41	91	365	2400	235	AR	38	73	345	25000	2150	200	AL	FT	55	25
2700 2700		AR AR	- 1	- 1	- 1	360 355	20000 15000	2550	270	AR	FT	95	340	2600 2400	255 255	AR AR	FT FT	87 80	350 325	2450 2250	240 240	AR AL	1	1	325 305	20000 15000	2100 1900	200 205	AL AL	FT FT	1	27 26
2700	280	AR	1	6	108	330	10000	2500	270	AR	42	89	315	2400	255	AR	39	73	300	2300	245	AL	┿	⊢-	285		1650		AL	FT	46	24
2700		AR	- 1		- 7	305		2500	270	AR	42	82	29d	2400	255	AR	38	67	275	2350	245	AL	36	56	265	5000	1600	210	AL	36	43	23
2700	280	AR	۱ ا	16	98	285	9. L.	2500	270	AR	42	76	270	2400	255	AR	38	63	255	2350	245	AL	36	52	245	S. L.	1600	210	AL	34	41	21

- T ALLOW 29 GAL FOR WARM-UP, TAKE-OFF & INITIAL CLIMB
- 2. IF 85-GALLON FUSELAGE TANK IS INSTALLED AND SERVICED. WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING

EXAMPLE AT 10, 300 LB. GROSS WY. WITH 240 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 950 STAT AIRMILES AT 10,000 FT. ALT.

MAINTAIN 2300 RPM AND 245 MPH IND. AIRSPEED

I.A.S.: INDICATED AIRSPEED M.P.: MANIPOLD PRESSURE G.P. H.: U. S. GAL, PER HOUR T.A.S.: YRUE AIRSPEED

F. T.: FULL THROTTLE F. R.: FULL RICH A. R.: AUTO-RICH A. L.: AUTO-LEAN C. L.: CRUISING LEAN

RED FIGURES ARE PRELIMINARY, SUBJECT TO REVISION AFTER FLIGHT CHECK

LEGEND

PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

TO WING TANKS.

	igure
(Two 500-lb. Wing Bombs-10,000 to 8500 lbs.)	igure 48—Flight Operation Instruction (
Bombs-10,0	Instruction
100 to 8500 lbs.)	Chart-V-1650-7 Eng
	, Eng

RESTRICTED

71

MODEL(S) P-51D	FLIGHT	OPERATION	INSTRUCTION	CHART	•

EXTERNAL LOAD ITEMS

2 - 500-LB. WING BOMBS

ENGINE(S): V-1650-7 M. P. BLOWER MIXTURE TOTAL R. P. M. LOW H I GM 194 3000 67

LOW

LON

AR

AR

15

CONT.

2000

2700

NORMAL BATED

61

46

CHART WEIGHT LIMITS: 10,000

178

109

TO 8500 POUNDS INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Ver-

NOTES: Column I is for emergency high speed cruising only. Columns II. III. IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gailons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid ex-

ceeding manifold pressure more than 8 in. Hg.

		I				i	FUEL			II			- 1			Ш			1			IV				FUEL			V			
	RANGE	IN AI	IR MI	LES		_	u. s.		RANGE	IN AIR	MIL	CS			RANGE	IN AIR	MILE	s			RANGE	IN AIR	MILE	8		U. S.		RANGE	IN AIR	MILI	£Ş.	
STA	TUTE		N.	UTI	CAL	,	GAL.	STA	TUTE	1	NAU	TICAI		STA"	TUTE		NAU	TICA	L	STA	TUTE		NAUT	TCAI		GAL.	STA	TUTE		NAU	TICA	Ļ
3. #3	20 70			360 320			190 190 194	5	Ф 24 00 40	G A	4	A L L 30 80	ow.	_	N O T 80 51 O	AV	50		LE	(	LIGH 580 500	T	Ф <sub>5 8</sub>	-	1	184 160	80	00		74 61	10 10	
_	10			270 230			120		70		-	20 70			130 360		-	80 10			510 420		-	40 70		120 100		00 , 00			20 40	
2	10			180	)		80		50			10			290		_	50			340		_	90		80	1	00			50 70	
1	50			130	)		60	1	80		1	60			210		I	90			250		2.	20		60	3	00	$\bot$		70	
1	00			90	,		40	1	20		1	10			140		1	20			170		1	40		40	2	00		1	80	
	50			40	)	1	20		60			50			70			60			80	-		70		20	1	00			90	
×	CAXIMU	K CO	NTIN	uou	8	$\dashv$			OPER.	ATING	DATA				OPER	ATING	DATA				OPER.	ATING I	ATA		$\neg \dagger$			MAXI	MUM R	ANGE		
R. P. M.	LAS. M.P.E.	MIX- TURI		. 1	G. P.	T. A.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX- TURE	M. P. In. Hg.	G. P. K.	T. A. B.	R. P. M.	L A. S. K.P.E.	MIX- TURE	M. P. In. Hg.	G. P. H.	T.	R. P. M.	L A. S. M.P.M.	MIX- TURE	M. P. In. Mr.	G. P. E.	T. A. E.	ALT. Feet	P. P. M.	L A. B. M.P.M.	MIX- TURE	M. P. In. Mg.	7.	T. A. B.
							40000 85000 80000																			40000 85000 30000						
27.00	260	AR.	46		15	385	25000							2450	245	AR	<b>#1</b>	90	365	2400	235	AR	37	73	345	25000	2150	200	AL	FT	_	300
2700	270	AR	F.	r i	00	365	20000							2550	255	AR	FT	85	345	2400	240	AL	FT	68	325	20000	2100	205	AL	FT	50	280
2700	280	AR	40	5 1	13	355	15000	2500	265	AR	FT	97	335	2400	255	AR	38	79	320	2250	240	AL	36	64	305	15000	1850	205	AL	FT	-	260
2700	280	AR	144	5   I	80	330	10000	2500	265	AR	42	89	310	2400	255	AR	1		295	2300	i	AL	36		285		1700	210	AL	FT	1	24!
2700	280	AR	40	5 1	03	305	5000	2500	270	AR	42	83	290	2400	255	AR	39	68	275	2350		AL	1	1	265			210	AL	35	42	1
2700	280	AR	4	6	98	285	S. L.	2550	270	AR	43	78	270	2400	255	AR	39	63	255	2350	245	AL	36	52	245	S.L.	1600	210	AL	34	39	210

tically below and opposite desired cruising altitude (ALT.) read

optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES T ALLOW 24 GAL FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE AT 9800 LB. GROSS WT. WITH (AFTER DEDUCTING TOTAL ALLOWANCES OF 24 GAL.) TO FLY 600 STAT. AIRMILES AT 10,000 FT. ALT. MAINTAIN 2300 RPM AND 245 MPH IND. AIRSPEED WITH MIXTURE SET AUTO LEAR

L.A.S.: IMDICATED ARSPEED BL.P.: MANIPOLD PRESSURE C.P.M.: U.S. GAL. PER HOUR T.A.S.: TRUE AIRSPEED S.L.: SEA LEVEL

F. T.: FULL THROTTLE F. R.: FULL RICH A. R.: AUTO-RICH A. L.: AUTO-LEAN C. L.: CRUISING LEAN

(Combat Tanks—10,700 to 9600 lbs.)	Figure 49—Flight Operation Instruction Chart—V-1650-7 Engine
o 9600 lbs.)	n Chart-V-1650-7
	* Engine

RESTRICTED

MODEL(S)	PLIQUE OPPRATION INSTRUCTION	N AUADT
P-5ID	FLIGHT OPERATION INSTRUCTION	N CHARI

EXTERNAL LOAD ITEMS

CHART WEIGHT LIMITS: 10,700

POUNDS

2 - 75-GALLON COMBAT TANKS

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 3 in. Hg.

		I				FUEL			п						m			. 1			IV				FUEL			V			
	RANGE	IN AIR	MIL	ES		U. S.		BANGE	IN AIR	MILE	3			RANGE	IN AIB	MILE	:3			BANGE	IN AIR	MILE	3		T. S.		RANGE	IN AIR	MILI	23	
STAT	TUTE		NAU	TICA	L	GAL.		TUTE		NAU.	rica1	L	STA	TUTE		NAU	MCA	-	8T/	TUTE		NAUT	TICA	L	GAL.	STA	TUTE		NAU	TICA	L
10	000		8.	70		390 #19		1 <u>29</u> 210	GA	10		οw		10 M	AV	12	A B 30	LE		LIGH 610	T	T 14	00		380 #18	_	<b>82</b> 0		15	80	
٤	20		80	0 .		360	1	120		9	70		1:	310		11.	30		1	490		12	90		360	ı	680		. 14	60	
ε	150		73	10		330	10	020		8	90		1:	200		104	0		ı	360		11	80		330	1	540		13	30	
7	770		67	0		300	1	930	$\perp$	8	00		- 1	090		94	0			240		10	70	_	300	1	400	$\bot$	12.	10	
	390		60	_		270		330			20			980		85	-		1	110		_	60		270		280		108		
	AXIMU	M CON	53			240		740 OPER	Tribic 1		40		'	870	ATING	75	_			990	ATING I	_	60	_	240	1	120	MUM R		70	
R. P. M.			M. P. In. Hg.	$\overline{}$	T.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX- TURE	M. P. In. Hg.	G. P. ML	T.	R. P. M.	l	MIX- TURE	M. P. In. Hg.	G. P. H.	7. A. B.	R. P. M.		MIX- TURE	M. P. In. Mg.	a. P.	T. A.	ALT. Feet	R. P. M.	L.A.S. M.P.X.	MIX-	M. P. In. Hg.	G. P. H	T.
2700	245	AR	FT	105	390	40000 35000 30000							2600	235	AR	FT	•••	375	2500	225	AR.	FT	7.0	260	40000 85000 30000	2400	195	AL	FT	61	,
2700	255	AR	46		375		_			-			2400	235	AR	FT		350	2400	230	AR				25000	2200	200	AL	FT	57	_
2700	260	AR	FT	100	355					$\vdash$			2550	250	AR	FT	84	340	2400	230	AL	FT			20000	2150	200	AL	FŤ	54	2
2700	275	AR	46	1 '	345		2500	260	AR	FT	96	330	2400	250	AR	39	78	315	2250	240	AL	36	ı		15000	2000	210	AL	FT	52	2
2700	275	AR	46	108	320	10000	2500	260	AR	42	89	305	2400	250	AR	38	72	290	2300	240	AL	36	61	280	10000	1750	210	AL	FT	48	2
2700	275	AR	46	103	300		2500	265	AR	42	83	285	2400	250	AR	38	67	270	2300	240	AL	36	57	260	5000	1600	205	AL	36	44	1
2700	275	AR	46	98	280	S. L.	2550	265	AR	43	75	265	2400	250	AR	38	62	250	2300	240	AL	36	52	240	S. L.	1600	200	AL	34	39	1

NOTES

V-1650-7

67

61

46

M. P. BLOWER MIXTURE (IN. HG.) POSITION POSITION

TOM

48

AR

TIME LIMIT

15

CONT.

TOTAL G. P. H.

194

178

109

ENGINE(S):

3000

2000

2700

LIMITE

WAR

MILITARY

HIGH BLOWER ABOVE HEAVY LINE ONLY.

# EXAMPLE

AT 10,500 LB. GROSS WT. WITH 390 GAL OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY 1500 STAT, AIRMILES AT 25,000 FT. ALT. MAINTAIN 2400 RPM AND 230 MPH IND. AIRSPEED WITH MIXTURE SET AUTO RICH - HIGH BLOWER.

### LEGEND

L.A.S.I INDICATED AIRSPEED M.P.: MANIFOLD PRESSURE G.P.M. U. S. GAL. PER HOUR T.A.S.: TRUE AIRSPEED S.L.: SEA LEVEL

F.T.: FULL THROTTLE F.B.: FULL RICH A.B.: AUTO-RICH A.L: AUTO-LEAN C.L: CRUISING LEAN

ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB
PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REC'D.

<sup>2.</sup> IF 85-GALLON FUSELAGE TANK IS INSTALLED AND SERVICED. WARM-UP, TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TANK UNTIL AT LEAST 50 GALLONS ARE USED BEFORE SWITCHING TO COMBAT TANKS.

Figure

50-Flight Operation Instruction Chart-V-1650-7 Engine (Combat Tanks-9600 to 8000 lbs.)

MODEL(S) P-51D

# FLIGHT OPERATION INSTRUCTION CHART

8000

POUNDS

EXTERNAL LOAD ITEMS 2 - 75-GALLON COMBAT TANKS

V-1650-7 ENGINE(S): BLOWER MIXTURE POSITION POSITION TOTAL G. P. H. M.P. (IN. MG. TIME LIMITS 2000 67 AR WAR 6 FOR 178 178 2000 61 AR LON NORMAL BATED 2700 46 AR CONT.

CHART WEIGHT LIMITS: INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

9600

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Manifold pressure (M. P.), gallons per hour (G. P. H.) and true airspeed (T. A. S.) are approximate values for reference. For efficiency maintain indicated airspeed (I. A. S.) hourly. Adjust RPM slightly if necessary to avoid exceeding manifold pressure more than 8 in. Hg.

		I				FUEL			11						Ш						IV				FUEL			. V			
	BANGE	IN AII	R MIL	28		U. S.		RANGE	N AIR	MILE	8	$\neg$		RANGE	IN AIR	MILE	5			RANGE I	N AIR	MILE	3		U. S.			IN AIR			
STA'	TUTE		TAT	TICA	L	GAL.	STA?	TUTE	T	NAUT	TCAL		BTA	TUTE		NAU	ICAL		STA	TUTE	1,	TUAN	ICAI	4	GAL.	STA	TUTE		NAU	TICA	Ŀ
	310			30		240 269	71		GA1	64	0	ō₩.	_	860	AV.		50	LE	10	LIGH 040	T	90			269 240		80			20	
	540		4	70		210	68	50	1	56	0		7	60		- 6	50	_		310		78	0		210	10	30		. 8	90	_
1	460		4	00		180	56	30		48	0		•	340		5	80		-	780		67	0		180	8	80		7	70	
8	380		3	30		150	46	30		40	0			540	10.00	4	30			350		56	0		150	7	40	$\bot$	6	40	
;	310		2	70		120	37	70		32	0		1	130		3	70		ı	520		45	0		120		90	.	5	10	
1	230		2	00		90	28	30		24	0		8	320		2	80		3	390		34	0.		90	14	50		3	90	
	150 70			30		60 30		30 <b>90</b>		16	0			210		_	80 90			260		22	-		60 30	1	300 50		_	260 230	
	IAXIMU	M CON	TINU	DU8		-		OPERA	TING I	ATA		-		OPER	ATING	DATA	_			OPER	TING I	ATA		_			MAXI	NUM R	ANGE		
R. P. M.		MIX-	M. P.	g.	T.	ALT. Feet	R. P. M.	L A. S. R.P.E.	MIX- TURE	M. P. In. Hg.	G. P.	T.	R. P. M.	LAS.	MIX- TURE	M. P. In. Hg.	G. P. M.	1. A.	R. P. M.	L A. S. N.P.R.	MIX- TURE	M. P. in. Mei	G. P. M.	T. A.	ALT. Feet	R. P. M.	L A. S. M.P.E.	MIX- TURE	M. P. In. Eg.	G. P. E.	T. A.
						40000 85000																			40000 35000						
2700	245	AR	FT	10	390	80000							2600	235	AR	FT	_		2500	225	AR				30000	2350	190	AL	FT	57	_
2700	255	AR	46	TH	376	25000							2450	240	AR	41	89	355	2400	225	AR			335		2150	190	AL	-	_	+
2700	260	AR	FT	100	355	20000							2550	250	AR	FT			2350	225	AL	1	1	310		2050	195	AL	FT	1	26
2700	275	AR	46	113	345	15000	2550	260	AR	FT	_	_	2400	250	AR	39	_		2200	235	AL	-	-	295	<del></del>	1850	200	AL	FT	44	23
2700	275	AR	46	1	320		2550	260	AR	43		305		250	AR	38			1	235	AL	1			1	1650	200	AL	34	41	22
2700	275	AR	46		300		2550	265	AR	43			2400	250	AR	38	1		2150	235	AL	36		255			200	AL	34	38	21
2700	275	AR	46	9	8 280	8. L	2550	265	AR	43	77	265	2400	250	AR	38	63	250	2150	235	AL	36	49	¥35	, S. L.	1800	205	^L	194	130	14.

NOTES

ALLOW 29 GAL. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB PLUS ALLOWANCE FOR WIND, RESERVE & COMBAT AS REQ'D.

HIGH BLOWER ABOVE HEAVY LINE ONLY.

EXAMPLE

LB. GROSS WT. WITH 240 GAL OF FUEL 9500 (AFTER DEDUCTING TOTAL ALLOWANCES OF 29 GAL.) TO FLY \$50 STAT. AIRMILES AT 20,000 FT. ALT.
MAINTAIN 2550 RPM AND 225
WITH MIXTURE SET AUTO LEAR.

# LECEND

L.A.S.: INDICATED AIRPRED M.P.: MANIFOLD PRESSURE C.P.H.: U.S. GAL PER HOUR T.A.S. TRUE AIRSPEED

<sup>2.</sup> IF BB-GALLON FUSELAGE TANK IS INSTALLED AND SERVICED, MARN-UP. TAKE-OFF, CLIMB, AND CRUISE ON FUSELAGE TARK UNTIL AT LEAST SO BALLONS ARE USED BEFORE SWITCHING TO COMBAT TANKS.

F.T.: FULL THEOTTLE F.R.: FULL RICH A.R.: AUTO-RICH A.L.: AUTO-LEAN C.L.: CRUISING LEAN

4-1-4a			T MOD						T			•	LIMI						ART		-			-			NE MOD 350-3	EL(S)	
	Т		1		HAD	D 511	DETC	E RUN1	WAY.		1 / 1	1	OFF	וע			RF RU					1		505	T 011	ID EA	CE RUN	UAV	
GROSS WEIGHT	1	EAD	AT	SEA LI			3000			T 600	O FEE	_	AT SEA	LEYEL	_		000 FE		AT 6	000 F	FT	AT 9	EA LE				FEET		000 FEET
LB.	H.P. H.		GROU		CLEAR O' OBJ.	GRO		O CLEAR		DUN D	TO CL		GROUND RUN	TO CLI		GROUN	1	LEAR OBJ.	GROUNG	TO	LEAR OBJ.	BROUN	D TO	CLEAR O'OBJ.	BROU	GRI	TO CLEAR		
9000	0 17 34 51	0 15 30 45	135 100 75 50	0 2	000 1550 150 850	150 115 80 55	0	2200 1700 1300 950	17	00 00 50 50	2450 1950 1500 1100		1450 1050 750 500	2 100 1600 1200 850		1500 1200 850 600	22! 180 13! 100	50 50 50	1800 1350 1000 700	2! 20	00 00 50	1600 1200 850 550	22 17 13	50 50 00	1750 1350 950	0	2450 1900 1400 1050	2000 1500 1100 750	2750 2200 1650
11,000	0 17 34 51	0 15 30 45	185 135 95 65	0 2	700 150 1600 150	200 150 140 75	0	2950 2300 1750 1250	13	50 00 00	2650 2650 2050 1500		1950 1450 1050 7 <b>00</b>	2800 2200 1650 1200		2100 1600 1200 800	30! 240 18!	50	2400 i850 i400 950	27	00 00 00 50	2250 1700 1200 800	24	50 50 50 50	2406 1906 1406	0	2400 2700 2058 1500	2800 2150 1600	2300
13,000	0 17 34 51	15 30 45	170 120 120 85	0 2	1600 1800 1050 1550	250 190 140 100	0	3800 3050 2300 1750	28 22 16 12	00	4300 3400 2700 2100	. 1	2450 1850 1350 900	3700 2900 2150 1600		2650 2050 1500 1050	395 320 240 180	X0	3000 2350 1750 1300	36 28	50 00 50 50	2900 2200 1600	33	00 00 50	3200 2400 1800	0	4800 3700 2850 2100	3600 2800 2100	5300 4200 3200
												_	LIM	B D	AT/														
GROSS			A LEVEL				5000 F	EET FROM SEA	1 Cutt			0,000					5,000					20,000	FEE		Α'			.FEET	_
WEIGHT LB.	BEST !	KTS	CLIMB	OF FUEL	MPH .	KTS .	RATE OF CLIMB	TIME MIN.	FUEL USED	BEST	KTS	RATE OF CLIMB	FROM SE	FUEL USED	BEST		OF CLIMB	TIME	FUEL USED	BEST I	KTS	OF CLIMB	TIME	FUEL USED	MPH	KTS	OF CLIMB	TIME FU MIN. US	EL
9000 11,000 12,000	170	145 145 150	2200 1500 1000	15 15 15	170 170 175		2200 1500 950	2.5 3.5 5.5	19 20 23	170 170 175	145 145 150	2250 1500 900	5.0 7.0	23 26 32	170 170 175	145 145 1 <b>50</b>	2250 1500 850	7.5 10.5 17.0	27 <b>2</b> 2 42	165	145 145 145	1150	10.0 14.0 23.0	31 39 55	160	140 140 145	900	19.0	5 7 5
POWER PLANT SETTI DATA AS OF 5-8		AILS			OH III)		TS	:					1						L		FUEL	USED	(0.3.	BAL.)	INCTUD	ES WAI	RH-UP A	TAKE-OFF	ALLOWANCE
											LAI	4 D I	NG	DIS	TA	N	E re	ET											
GROSS	В	EST I	AS APP	ROACH			H	ARD DI	RY S	URFA	CE	***					FIRM	DRY S	SOD						WET	OR	SLIPP	ERY	
WE I GHT			FF PON				EVEL		000		+	6000		AT SE	_	VEL		000 FE	ET	AT 60	00 FE	ET .	AT SEA	LEVE	L /	AT 30	00 FEE	TAT	OOO FEET
LB.	M	'H K	TS MPH	KT\$	ROLL		CLEAR O'OBJ.	ROLL		CLEAR O' OBJ.	GROU ROL		CLEAR O' OBJ.	ROLL		CLEAR O OBJ.	GROUN ROLL			GROUND ROLL	TO C		ROUND ROLL	TO CLE 50' 08		ROUND ROLL	TO CLE 50' 08		
9000 8000	13	- 1 -	15 130 15 130	115	1200		2300 2 1 <b>0</b> 0	1400	, ,	2400 2200	150	- ! -	2600 2400	1400	- 1	2400 2200	1600			1700 1500	1		200 900	4300 3806		500 100	4600	3900 8400	5000 4500
DATA AS OF 5-8-	45		BASED	ON: FL	IGHT	TES	13																		OPT	HAUM L		BOS OF CH	ART VALUES